4-2-2020

Academic Honesty, Professional Integrity, and Undergraduate Engineering Students: Exploring the Connections

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A Co-Authored Dissertation submitted to
The Graduate School at the University of Missouri-St. Louis
in partial fulfillment of the requirements for the degree
Doctor of Education with an emphasis in Educational Practice

May 2020

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Abstract

One benefit of inculcating professionalism into engineering degree program curricula is a measure of the extent to which future practitioners adopt an engineering code of ethics (Abaté, 2011; Davis, 2006). Studies have indicated more dishonesty among engineering students than other groups of undergraduate learners, but the effects of technology on dishonesty in the classroom was not addressed (Bowers, 1964; McCabe et al., 2012). An explanatory, sequential mixed methods study was designed to explain to what degree course pedagogical practices and attitudes of civil, architectural and environmental engineering students of various academic levels (freshman/sophomore and senior) relate to academic dishonesty. The design allowed for the collection of quantitative survey data from engineering students and the instructors who teach those students through self-reports of attempted dishonest behavior, perceived descriptive norms and descriptions/definitions of the behaviors by both students and their instructors and reporting the consistencies and inconsistencies between the two groups. Additionally, instructors were surveyed for the courses in the program sequence of courses which connected the two courses under study to determine student attitudes, intentions and actions as well as instructor perceptions of the same behavioral characteristics based upon Ajzen's (1991) theory of planned behavior.

Overall freshman/sophomore engineering students (n=31) described the 12 academically dishonest behaviors as less dishonest than graduating seniors (n=52). There were five statistically significant differences in attempted dishonest behaviors between the two student groups. Perceptions were also significantly different. Senior students perceived

dishonest behaviors similarly to instructors (*n*=6), for 11 of 12 dishonest behaviors while freshman perceived higher rates of dishonesty than the actual self-reports.

Keywords: academic dishonesty, cheating, undergraduate students, engineering

Acknowledgements

This process would not be complete until we acknowledge and thank those who have supported us on this journey. We are particularly thankful for the mentorship of our committee and for the willingness of the engineering faculty who eagerly welcomed us into their classrooms.

Jeffrey W. Jennings

I want to thank my research partner for working hard and supporting me when I messed up the calculations. Thank you, Amy. I would also like to thank my sons for sacrificing time with me but encouraging me to continue and always giving me the inspiration to become a better person. I would like to especially thank my wife, Kate, for her continued encouragement, support and pushing me forward to rise to my potential. I could not have made it without all of you. THANK YOU!

S. Amy Skyles

For tolerating me and my incessant jabbering as we drove the equivalent of halfway around the world just to make it to class, I thank you Jeff! I would also like to thank my husband, Brandon, for the coffee, my children for their patience, my sisters for their ever-present cheerleading, and my mother for always believing in me. Mom, this is for you.

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Chapter 1: Introduction

University faculty establish curricula for each of their degree programs. Science, technology, engineering, and mathematics (STEM)-focused curricula of undergraduate students often include theoretical foundations as well as hands-on, practical applications (ABET, 2020). A narrow focus on the content itself, however, overlooks some of the foundational components necessary for a full development of a professional within a field. According to Covey (2017), "in utilizing our human capacity to build on the foundation of generations before us...we have forgotten the foundation that holds it up" (p. 29). Covey continued with, "in reaping for so long where we have not sown, perhaps we have forgotten the need to sow" (p. 29). One benefit of sowing professionalism into the engineering degree curriculum is a measure of the extent to which future practitioners adopt an engineering code of ethics (Abaté, 2011; Davis, 2006).

The development of professional ethics as one progress through the undergraduate experience may be measured in comparison to academic integrity in the classroom environment. The appropriate measurement of integrity could include the discrepancies in the perceptions of and definitions of academic integrity among engineering students of various levels of professional maturity and the faculty who teach them.

Background

Institutions of higher education have failed to provide a consistent and clear universal definition of academic dishonesty (Carpenter et al., 2006; Jones et al., 2006, 2008). In addition to different definitions of academic dishonesty, institutions have a variety of policies, and different levels of enforcement of those policies. As a result, many educational institutions try to combat academic dishonesty through detailed honor

codes, which help to prevent mistakes by informing students of the expected standards of conduct (Davis, 2006). Though some research indicates that the use of an honor code alone does not prevent academic dishonesty (Cole & McCabe, 1996; May & Loyd, 1993; Jordan, 2001), other research has supported the adoption of a code, so long as the code is accompanied by supportive cultural changes within the institution that are in alignment with the code (Jordan, 2001).

Self-reported cheating at no-code schools remained fairly constant from the 1960s-1990s, with the exception of group work. During group work, self-reported cheating increased dramatically according to the early work of Bowers (1964) and evidence from follow-up surveys of no-code schools in the 1990's (McCabe et al., 2012). Additionally, "Collaboration is simply a behavior that today's students don't view as cheating, regardless of a faculty member's instructions for a given assignment" (McCabe et al., 2012, p. 54). The incorporation of technology in classroom assignments and collaborative activities may further change student opinions about cheating and related behaviors (Carpenter et al., 2010). Thus, a review of pedagogical strategies that instructors might use to encourage academic integrity is important, whether technology is incorporated or not.

Intrinsic motivation is a desire to learn a skill or gain knowledge for the sake of mastering the skill or learning itself (Lang, 2013). Intrinsic motivation has been associated with lower rates of academic dishonesty (Ryan & Deci, 2000b). Extrinsic motivation is using incentivized rewards that are unrelated to learning itself (Lang, 2013), such as grades, monetary value or social acceptance to incentivize work. Various pedagogical strategies are linked to student motivation. Active learning, a student-

centered learning practice where students are engaged in active participation instead of passive listening, is one such example of a pedagogical strategy linked to increased motivation and decreased academic dishonesty (Ambrose et al., 2010; Bain, 2004; Tovani, 2014).

Additionally, fair and authentic assessments, those in which learning simulates real-world scenarios, are associated with decreased academic dishonesty (Felder & Brent, 2016). These pedagogical strategies emphasize student interaction with one another while maintaining a focus on intrinsic motivation as opposed to extrinsic rewards, such as grades (Felder & Brent, 2016). According to Lang (2013), modification of the environment and not the learner will produce less cheating. The environment, however, is typically out of the control of the student.

When students perceive that they have no control, they are more likely to make dishonest choices. This relationship is described by Ajzen's (1991) theory of planned behavior. That theory also contends that the subjective norm of the behavior in a given environment can be influential on the decision to cheat (Ajzen, 1991). For example, if students believe that it is normal behavior to copy homework, even if they believe it is wrong to do so, they are more likely to copy from others or give answers. Given that information, if the culture of the institution is one of great academic integrity, as would be expected of a school with a strong honor code, then students would behave more honestly. The theory of planned behavior does not account for the moral development and maturity of the learner.

Studies have revealed discrepancies in the types and rates of cheating between students of various academic levels, from introductory levels through those who are

nearing graduation (Khalid, 2015; Passow et al., 2006). In engineering programs specifically, the development of professional ethics, which extends beyond ordinary morality (Abaté, 2011; Davis, 2006) may also be impacted by academic or grade level. According to Steele (2016), moral reasoning within an ethical framework is continually refined throughout life, so an expectation that undergraduate students, especially at the freshman and sophomore levels, will always perform ethically is unrealistic. Additionally, because prior cheating is an indicator of increased risk for future cheating, nurturing the development of professional ethics must begin early in the undergraduate experience (Passow et al., 2006).

Problem Statement

Three major deficiencies exist in the current literature on academic integrity in universities. First, early studies (Bowers, 1964; McCabe & Trevino, 1993) intentionally avoided collection of data on cheating behaviors from freshman-level students. This prevented students from reporting on dishonest behaviors from high school to ensure that all data collected were related to the college experience. Second, studies have also neglected to incorporate questions about academic dishonesty that specifically relate to the technologically enhanced or fully online classroom. Coupling the types of questions asked in early studies by Bowers (1964) and McCabe and Trevino (1993) with those which might provide insight into technology-focused pedagogy and by including freshman-level students, while polling them toward the end of their first and second semesters will provide a more comprehensive view of academic dishonesty for college students. Third, previous studies have focused on engineering students as a whole and not specific disciplines within the field of engineering, thus it is not described within the

literature whether any differences exist between various types of engineers. The study of a specific engineering discipline within the broader field may serve to inform issues about how academic dishonesty differs among sub-populations within engineering coursework.

The relationships between student attitudes toward cheating, their perceived control of such behaviors, and the norm of these behaviors in the undergraduate engineering classroom environment (whether that be face-to-face, online, or some combination of the two) may influence the decision to cheat. This phenomenon, as described by Ajzen's (1991) theory of planned behavior, supplies a framework for the research questions to be asked of students and faculty. The theory of planned behavior may also provide a framework for the development of interventions aimed at reducing academically dishonest behaviors.

A focus on normative trends may be descriptive or injunctive in nature. A descriptive norm is a pattern of behavior considered typical within a population, regardless of whether the behaviors are acceptable within the population. This contrasts with an injunctive norm, which describes acceptance or rejection of patterns of behavior within a population. Though injunctive norms may provide a greater social benefit, both descriptive and injunctive norms can guide behavior of the individual (Cialdini et al., 1991), because the choice of an individual may oppose the generally acceptable standards (injunctive norm) while still aligning with the socially acceptable standards (descriptive norm) within a population.

Purpose

An explanatory sequential mixed methods study was designed to determine how course pedagogical practices and attitudes of students of various academic levels (freshman/sophomore and senior) relate to academic dishonesty. The design allowed for the collection of quantitative survey data from engineering students and the instructors who teach those students. Additionally, instructors were surveyed for the courses in the engineering program sequence which connects introduction to engineering design and senior design. The survey's purpose was to determine student attitudes, intentions and actions as well as instructor perceptions of the same characteristics based on the theory of planned behavior.

The quantitative data is further explained through data collected during a qualitative interview of the engineering faculty. In Phase 1, college students majoring in engineering completed the quantitative survey to measure descriptions of, perceptions of, and attitudes toward cheating. The survey collected the self-reported rates of cheating by engineering students in two courses within the civil, architectural, and environmental engineering (CArE) course sequence, (introduction to engineering design and senior design). The survey also collected the descriptions of, and perceived rates of cheating as reported by faculty who teach within the same course of study.

The research site was a science, technology, engineering and mathematics (STEM)-focused, mid-western, public university with an undergraduate population of just under 7000 full and part-time students (Institutional Data, 2020). Using the theory of planned behavior, the assessment attempted to relate student level and faculty pedagogical practices to self-reported student rates of academic dishonesty. The

qualitative phase, Phase 2, was conducted as a follow-up to the quantitative survey to help explain the results. In the explanatory follow-up, course pedagogical practices and student level were related to survey data about academic dishonesty through interviews with faculty participants at the institution.

Research Questions

The overarching research questions under investigation explored how interviews with faculty about course pedagogical practices address:

- **Research Question 1 (RQ1):** What were the self-reported rates of dishonesty by undergraduate engineering students of various academic levels (freshman/sophomore and senior)?
- **Research Question 2 (RQ2):** What were the differences in perceptions of and descriptions of academic dishonesty between faculty and engineering students?
- **Research Question 3 (RQ3):** What relationships existed between dishonest choices made by students and the theory of planned behavior?
- **Research Question 4 (RQ4):** To what degree do pedagogical strategies correlate to the rates of dishonesty reported by students?

Hypotheses

There were several null hypotheses based on the research questions.

- **Hypothesis 1 ($H_0$1):** There would be no statistically significant differences between student groups in the reporting of their level of personal ethics and/or their self-reported rates of academic dishonesty.

- **Hypothesis 2 ($H_0$2):** There would be no statistically significant differences between the self-reported rates of academic dishonesty by undergraduate engineering students and the perceived rates of dishonesty by the faculty who taught them.
- **Hypothesis 3 ($H_0$3):** There would be no statistically significant relationship between engineering students' dishonest behaviors and their attitudes, perceptions, and descriptive cultural norms of such behaviors.
- **Hypothesis 4 ($H_0$4):** Pedagogical strategies would not influence the rates of self-reported academic dishonesty by undergraduate engineering students with statistical significance.

Delimitations

The student survey conducted in Phase 1 only included responses from students at the freshman/sophomore and senior levels, which are defined by the institution (Advising office, 2020). As a result, important information about measurable transitions that might occur between the two levels, by those who are classified as second semester sophomores and juniors, was ignored.

Age data for this study was collected within ranges that included ages of typical undergraduate students. The chronological age of the students was not a point of focus in the study. Non-traditional students who may be older and thus have more experiences by which to measure morality and integrity, then, were not be distinguished as a separate group.

Limitations

Limitations of the study include the lack of feasibility to generalize the quantitative findings to engineering degree programs other than those within the Department of Civil Architectural and Environmental Engineering (CArE) and generalization to an institutional level regardless of the STEM-focused nature of the institution under study. Also, because the two courses under investigation were at the time of study, with the exception of a handful of the students in the senior design class who participated remotely through a live-streamed environment, offered in a face-to-face environment, the findings are not generalizable to the online classroom environment, even though many assessments within the courses under study may make use of technological components. This includes the inability to generalize to the online classroom within other courses at the STEM-focused institution to be studied.

The qualitative interview of instructors during Phase 2 included all instructors who taught the two courses in which students were surveyed as well as instructors who taught applied engineering statics and mechanics of materials, the courses in the sequence which connects these two courses. However, because of the small sample size of this population, generalizability of the results across all engineering instructors was not possible. The information collected from the instructor interviews was only used in an attempt to explain the survey data collected from the students within their own classes and how it relates to the perceived rates of cheating as reported by the same instructors during Phase 1.

Assumptions

Students and faculty can both suffer consequences when cheating is identified in the classroom environment. Fear of punishment, loss of credibility, and other factors may prevent both students and faculty from responding to survey and interview questions honestly. The survey instruments used in the quantitative portion of the study, Phase 1, were distributed to students anonymously. It is assumed that because of the anonymity of the responses and the online format of the survey that students responded honestly (Knapp & Kirk, 2003). It is also assumed that, as professionals, faculty responses to both the quantitative survey during Phase 1 and the qualitative interview during Phase 2 were presented honestly. Finally, it is assumed that the student participants were representative of the general population of undergraduate engineering students within the Department of Civil, Environmental and Architectural Engineering at the institution and that the faculty were representative of the general population of engineering instructors (because more than one department was represented within the population of instructors).

Definition of Terms

Definitions of academic integrity and other related terms vary and are not universal across or even within some institutions (Carpenter et al., 2006; Jones et al., 2006, 2008). Behaviors that may be considered cheating or dishonest by one instructor may be encouraged by another. Furthermore, with the wide availability of information on the Internet, student opinions between and within institutions may differ as well (Carpenter et al., 2010). What follows is a list of definitions as they apply within this study. Comparisons within the study align with these definitions, but because of

discrepancies within the literature, they may not fully align with definitions related to academic integrity from other sources.

- **academic dishonesty:** "including but not limited to cheating, plagiarism, or sabotage" (UM System, 2020).
- **academic level:** the four grade classifications of freshman, sophomore, junior, and senior.
- **active learning:** a teaching technique that encourages student engagement and interaction. It provides "challenging yet supportive conditions in which learners feel a sense of control over their education; work collaboratively with others; believe that their work will be considered fairly and honestly; and try, fail, and receive feedback from expert learners in advance of and separate from any summative judgement of their effort" (Bain, 2004, p. 18).
- **authentic assessment:** measures which mimic actual professional situations and tasks and that provide students with a better reason to succeed than grades alone (Anderman & Koenka, 2017; Felder & Brent, 2016).
- **cheating:** "includes but is not limited to: (i) use of any unauthorized assistance in taking quizzes, tests, or examinations; (ii) dependence upon the aid of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; (iii) acquisition or possession without permission of tests or other academic material belonging to a member of the University faculty or staff; or (iv) knowingly providing any unauthorized assistance to another student on quizzes, tests, or examinations" (UM System, 2020).

- **culture:** the descriptive norm of the campus sentiment, both faculty and student, toward academically dishonesty behavior.
- **descriptive norm:** patterns of behavior considered typical within a population, regardless of whether the behaviors are acceptable within the population (Cialdini et al., 1991).
- **engagement:** the interaction of the student with course material, other students, and with the instructor.
- **engineering ethics:** attitudes and behaviors of morality beyond the mere understanding of engineering topics (Abaté, 2011).
- **extrinsic motivation:** when success on an assessment is incentivized with rewards that are unrelated to the learning itself (Lang, 2013).
- **formative assessment:** low-stakes measures of learning used by the instructor to gauge progress and provide timely feedback to students.
- **grounded assessment:** assessment that is uniquely designed for "each specific course you teach, each semester" (Lang, 2013, p. 76) Assessments may be grounded in time, location, current events, or by association to the students themselves (Lang, 2013), thus making them specific to students in that class at that point in time, but not reproducible by students in future semesters.
- **honor code:** a written policy that sets expectations for student academic behavior and defines dishonesty.
- **injunctive norms:** patterns of behavior that are generally acceptable within a population (Cialdini et al., 1991).

- **intrinsic motivation:** a desire to learn a skill or gain knowledge for the sake of mastering the skill or learning itself (Lang, 2013).
- **pedagogical practices:** use of strategies designed by teaching faculty that provide structure for interactions among any combination of faculty, students, and course content.
- **plagiarism:** "includes, but is not limited to: (i) use by paraphrase or direct quotation of author with footnotes, citations or bibliographical reference; (ii) unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials; or (iii) unacknowledged use of original work/material that has been produced through collaboration with others without release in writing from collaborators" (UM System, 2020).
- **professional integrity:** the ability to demonstrate ethical decision-making in a professional environment.
- **sabotage:** "includes, but is not limited to, the unauthorized interference with, modification of, or destruction of the work or intellectual property of another member of the University community" (UM System, 2020).
- **STEM-focused university:** school where at least 50% of students are majoring in the various fields of science, technology, engineering, or mathematics.
- **student attitude:** determined by the self-reported severity of specific dishonest behaviors defined by the study.

- **student intentions:** a purposeful plan by students to commit a specific behavior or action before being presented with the choice.
- **summative assessment:** measures of learning used to evaluate the final outcomes of a unit of study; typically, high stakes and without opportunities for feedback and improvement.

Summary

According to the accreditation standards of the Accreditation Board for Engineering and Technology (ABET), engineering curricula should instill a sense of professionalism in each graduating student (ABET, 2020). Content knowledge accumulates over several years of experience and practice. So, too, does professional knowledge and ethical development (Steele, 2016). Because it is unreasonable to expect undergraduate students to develop professional integrity without adequate exposure and guidance, STEM-focused institutions of higher education need to develop a better understanding of the factors that lead to the development of professionalism. To contribute to this effort, this study investigated the discrepancies in the perceptions of and descriptions /definitions of academic integrity among engineering students of various levels of professional maturity and the faculty who teach them at a STEM-focused institution.

Chapter 2: Literature Review

Academic dishonesty is a concern on college and university campuses across the world. Depending on major, as many as 60 percent of students engage in dishonest behavior in higher education, with engineering students having among the highest self-reported rates (Bowers, 1964; McCabe et al., 2012). This review of the literature is an attempt to determine the discrepancies in the perceptions of and descriptions of academic integrity among students of various levels of professional maturity and faculty within an undergraduate engineering program.

The International Center for Academic Integrity (2020), described integrity as essential in the development of professionalism as students progress toward degree completion. Though blatant acts of academic dishonesty may be generally recognizable within academia, there has historically been substantial variation in definitions of the term between institutions and individuals (Carpenter et al., 2006; Jones et al., 2006, 2008). Furthermore, as new technologies emerge (mobile devices, wearable technology, etc.) institutions must continually reevaluate and update policies and guidelines for implementing academic integrity regulations (Jones et al., 2006; Lang, 2013).

Though academic dishonesty is "distressingly prevalent" in modern education (Carpenter et al., 2006, p. 181), it is not a new concept in the twenty-first century classroom. Lang (2013) quoted a twentieth century Ivy League school administrator, who described the atmosphere of dishonesty in education by saying, "a state of war exists between faculty members and students," (p. 5). Since that time, many of the technological means have changed in this "war," however, the fundamental basis still

exists: instructors must assess students and some students, often many, will risk their own integrity to gain a perceived advantage.

Studies have shown that dishonest behavior may vary between students of differing academic levels (freshman, sophomore, junior, senior) (Khalid, 2015; Passow et al., 2006) and that the use by faculty of differing pedagogical practices may serve to either hinder or remedy the situation (Khalid, 2015; Lang, 2013). The coupling of these two factors, instructional use of best pedagogical practices and student academic level, may provide insight into the reasons why students cheat, and how to best prevent dishonesty in the classroom.

Definitions of Academic Dishonesty

The wide availability of information on the Internet can be helpful for researchers, instructors, and students. But it has also led to opportunities for dishonesty (Jones et al., 2006; Williams, 2001). And just as the definitions of integrity and honesty vary, their situational applications may vary as well. Furthermore, because many instructors believe that the definitions of cheating and academic integrity are universally understood, they frequently do not describe them in detail within their syllabi (Carpenter et al., 2006), even though experts such as Felder and Brent (2016) recommend in the absence of a school honor code that instructors should include a definition of cheating and policies for dealing with infractions within their syllabi. Additionally, “educators must clearly define what they mean by ethics” if they wish for their students to begin learning to develop ethics in professional situations (Hess & Fore, 2018, p. 576). Such definitions and descriptions are needed in all classes, no matter the delivery mode (face-to-face, blended, online, etc.).

An emerging concern is the integrity of the student experience in classes that use an online delivery mode. The conversion of course materials to the online environment can have real and significant implications because, “It appears as if the use of technology and/or the use of out of class examinations change student’s opinions of cheating” (Carpenter et al., 2010, p. 1158), which may lead to an even greater discrepancy between what instructors and students perceive as dishonest. In these situations, the lines of distinction between honest and dishonest actions are blurry and may be made even more so with the incorporation of technology.

From a survey of 52 engineering students, Kelly and Dooley (2014) reported that 96% of surveyed incoming freshman believe that copying homework from another student is cheating, but that only 21% believe that copying from a solutions manual is cheating. This discrepancy in attitudes and definitions is widely observable. Furthermore, student definitions of what constitutes plagiarism and cheating during collaboration and group work vary widely. According to McCabe and colleagues (2012), “One of the most important confounding factors in this research may be the changing student definitions of what constitutes cheating, particularly in areas such as plagiarism and unauthorized collaboration” (p. 38). Additionally, varied descriptions and reporting of definitions may indicate different attitudes toward dishonesty.

Is the instructor really the only authority on classroom integrity or is there a larger institutional responsibility to define academic integrity and to enforce related policies? The idea that there is an interplay between the individual and the broader organization is referred to as the structure and agency problem, and there are varying opinions as to whether the structure and agency can be separated from one another for study (Grix,

2010). A micro-level approach to structure is proposed in this study to examine the individual students and faculty within the context of a macro-level agency, the university, which had adopted a student honor code. Evidence already reported indicates that students do not truly understand the meaning of academic integrity (Carpenter et al., 2006; Jones et al., 2006, 2008), and when technology or active learning and collaboration are added to the classroom environment, their confusion increases (Carpenter et al., 2010; McCabe et al., 2012; Kelly & Dooley, 2014). Such confusion can be alleviated, at least partially, by the creation and implementation of an institutional student honor code (Carpenter et al., 2010; McCabe & Trevino, 1993; Robinson & Glanzer, 2017). It could be argued that the honor code itself does not prevent cheating, but rather the culture of integrity created by continued enforcement and reminders of such a code are the factors which realistically prevent cheating.

Uses of Honor Codes

An honor code is a written policy that sets expectations for an institution and defines dishonesty. Implementation of honor codes in various professions and academic settings prevents mistakes that may occur in environments where individuals who should know better, do not (Davis, 2006, p. 720). According to the University System, academic dishonesty includes plagiarism, cheating, and sabotage (2020). This definition provides a foundation for the honor code created by the student council at the university under study. This student-generated code states that,

> We shall hold ourselves to a high standard of integrity both on campus and off, seeking to uphold this high standard of conduct and encourage such

attitudes and actions in others. We believe that the most important aspects of a strong moral code are based in Honesty and Respect (STUCO, 2016).

But just having an honor code does not automatically produce an environment of integrity (Cole & McCabe, 1996; May & Loyd, 1993). Jordan (2001) wrote "the introduction of honor codes, may not be effective in the absence of other institutional changes" (p. 234) as institutions with honor codes often have high rates of cheating. Miller et al. (2017) contended "the effects of these codes are declining, because students value grades more than an abstract moral standard" (p. 126). However, it is still better for students to learn ethics while in school than afterward, when practicing as professionals (Davis, 2006, p. 720).

Miller et al. (2017) stated, "At a basic level, schools must provide information on academic integrity and specific definitions of what is considered cheating, as students often do not understand what constitutes academic dishonesty" (p. 126). Instructors may provide such policies to students or refer them to a link on the website of the institution, but follow-up and dialogue with explicit descriptions for each assignment may be limited or absent altogether. With this possible decline of effective honor codes, what can institutions do to decrease academic dishonesty and how do students learn about the honor code?

Earlier research comparing academic dishonesty at institutions with honor codes to those without revealed promising results in favor of the use of honor codes, and there is a rather large body of such empirical evidence (McCabe & Trevino, 1993). One possible weakness, however, is the "reluctance of faculty to work within the academic codes despite institutional requirements to do so" (Carpenter et al., 2010, p. 1161). If an

honor code is missing or an instructor refuses to use such a code, there are still many methods which can be used by individual instructors to discourage cheating and academic dishonesty. Such strategies are often designed in a manner conducive to incorporation into traditional and online classes.

Students on campuses with a strong culture of ethics still report levels of cheating that could negatively impact the reputation of the school. These instances of academic dishonesty may be attributed to any number of reasons, but some likely culprits are the relationships among student attitude, perceived behavioral control, and environmental norm, all described by the theory of planned behavior (Ajzen, 1991).

Theory of Planned Behavior

The majority of surveyed students do not believe that cheating is necessary in order to be successful (Carpenter et al., 2010). But they still knowingly conduct dishonest behaviors (Carpenter et al., 2006). This idea may bring to mind the phrase, “it’s the thought that counts.” This idea provides a basis for the discussion of how the theory of planned behavior (TPB) can be used to explain academic dishonesty (Carpenter et al., 2010; Harding et al., 2007; Coren, 2012; Passow et al., 2006).

According to Ajzen (1991), “To the extent that a person has the required opportunities and resources, and intends to perform the behavior, he or she should succeed in doing so” (p. 182). In comparison to dishonest behaviors in the classroom environment, the theory of planned behavior explains that if students approach classwork with an incoming intent to be honest, they are likely to be successful in their honesty as long as the environment provides all of the necessary learning components to them within the context of any specific course assessment. Additionally, because the theory of

planned behavior often relates well to situations in which subjects do not have complete volitional control over the nature of work to be performed, the classroom environment and specific pedagogical practices and/or assessment strategies designed by college faculty are well-suited for study using the theory of planned behavior (Ajzen, 1991).

The theory of planned behavior relates the attitude toward a specific behavior, the subjective descriptive norm of the behavior in a specific population, and the perceived control by the subject over the behavior. These three factors influence the intent to commit the behavior, which results in the choice to commit or avoid the behavior in question (Ajzen, 1991). As mentioned, the overall societal attitudes toward ethical behavior have been questioned, which leads to the need for additional discussion about the attitudes of learners in higher education and whether student descriptions of dishonest behaviors may be used as predictors of attitude toward dishonesty.

Students will commit acts which, when asked, they define as cheating (Carpenter et al., 2006; Murray & Henslee, 2014), but those same students may also describe themselves as ethical individuals (Murray & Henslee, 2014). Students also report that there are distinctions between unethical behaviors and cheating (Carpenter et al., 2006), which highlights the need for a proper definition of and well-defined guidelines for academic integrity and specific acts of dishonesty on college campuses. Carpenter and colleagues (2006) stated that “In conversations with faculty, most do not make a distinction between something being unethical and cheating” (p. 185). The resulting discrepancy in the distinction between faculty definitions and student definitions may help to explain why students cheat even though they do not perceive themselves as unethical people.

Even in the presence of clearly defined institutional guidelines and honor codes, college faculty need to provide context-specific guidelines within their syllabi and for each unique assessment. Additionally, it is the faculty responsibility to ensure that specific pedagogical practices and assessment techniques proactively promote honesty while dis-incentivizing or even punishing dishonesty (Felder & Brent, 2016). A look at the various rates of cheating, with specific attention to those of engineering students, will help to paint a picture of the need for proactive approaches to handling academic integrity.

Rates of Academic Dishonesty

The first large-scale survey measuring academic dishonesty indicated that the majority of college students cheat on their classwork, and that engineering students are among the most likely to cheat (Bowers, 1964). However, the rates of academic dishonesty may be lower at schools with strong honor codes (McCabe & Trevino, 1993). Though instances of certain categories of cheating behaviors such as cheating on exams, homework, or collaborative work may have changed, the overall rates of cheating behaviors reported by college students between the time of Bowers' (1964) initial large-scale survey and subsequent surveys conducted by McCabe and colleagues in the 1990's remained fairly constant, with one notable increase being in collaborative work (McCabe et al., 2012). These surveys of the 1960's and 1990's intentionally neglected data for the cheating rates of college freshman because of their limited college experience (Bowers, 1964; McCabe & Trevino, 1993).

Passow et al. (2006) conducted a study to assess rates of academic dishonesty on homework and exams specifically for engineering students and included students in their

first year of college as well as additional measures of comparison in an attempt to explain why students might choose to cheat. One finding from the study was related to prior cheating in high school. The resulting data indicated that cheating in high school contributed significantly to a 10% variance in cheating on exams in college beyond what could be explained by demographics alone (Passow et al., 2006).

Other surveys indicated that students have different perceptions as to what constitutes low academic integrity, and as a result, the rates of self-reported cheating were often difficult to quantify, no matter the student level (Carpenter et al., 2010; Jones et al., 2008; Miller et al., 2011). What can be determined from such studies is that academic dishonesty, no matter the definition, is happening in academia today. The next section examines what researchers have found to be the causes for that dishonesty.

Factors Leading to Dishonesty

Many instructors using traditional assessment strategies place great emphasis on a small number of large, high-stakes assessments (Anderman & Koenka, 2017; Williams, 2001). With such an emphasis on a single performance, as seen in the early Olympic Games where there was only one winner at the main event, people are enticed to cheat in order to be successful (Lang, 2013). In addition to making success more difficult, high stakes assessments, such as the midterm and final exam, create anxiety for students when their grade may be riding on their performance on those two key events. According to Williams (2001), secondary “teachers who use a variety of innovative methods are able to seek verification [of achievement] in a range of ways which give a much wider degree of assurance” (p. 237). This helps to validate the claim by Carpenter et al. (2010), that when students enter college, they “will place the blame for cheating on the instructor” (p.

1159), because the instructor may have not sufficiently taught the material or possibly assigned too much (Carpenter et al., 2006). The validity of such student claims related to pedagogical practices could be further enforced with additional examples presented within the literature.

Lang (2013) provided four reasons why students cheat in the classroom:

a. An emphasis on *performance*

b. *high stakes* riding on the outcome

c. an *extrinsic* motivation for success

d. a *low expectation of success* (p. 35)

All four of these reasons can be found within the Olympic Games example. The traditional classroom environment may also include all four of Lang's reasons to cheat. When students are provided with only a few key assessments throughout the course of the semester, without much practice, and with the only motivator being grades, it is not surprising that they would have a low sense of self-efficacy and that they might feel the desire to cheat.

Using course design and pedagogical practices to curb dishonesty is a valid consideration. Some strategies include the use of scaffolding, deliberate practice, and formative assessment (Ambrose et al., 2010). Each of these strategies helps to emphasize mastery and communicate expectations while providing a dialogue about cheating, when there is not a heavy emphasis on grades. These concepts were also included in Anderman and Koenka's (2017) strategies to decrease academic dishonesty.

Additionally, as a student progresses through a degree path, the types of assessments and pedagogical practices within each course may vary, with lower-level

courses focusing more on vocabulary and theory while upper-level courses may incorporate culminating design projects and enhanced experiential learning components. This leads to a discussion of how a student's academic level (freshman, sophomore, etc.) affects attitudes and behaviors related to academic dishonesty.

Student Academic Level

Passow et al. (2006) addressed the level of the engineering learner including learners who were classified as freshman, sophomores, juniors, seniors, and graduate students. The results indicated that reported rates of dishonesty change throughout the educational career depending on student level, but those rates may vary dependent upon other factors as well. For example, Passow et al. concluded that undergraduate students at an upper-level (juniors and seniors) cheat more on exams while undergraduate students at a lower-level (freshman and sophomores) cheat more on homework (p. 673), while Khalid (2015) concluded that undergraduate upper-level students cheat more via plagiarism due to the changing nature of the assessment and pedagogical practices used as a student approaches graduation (p. 6). The revelation about plagiarism by Khalid may help to explain why Henslee, Goldsmith, Stone, & Krueger (2015) did not see improvement in behaviors related to plagiarism when studying the effect of an online training module for freshman undergraduates; freshman may be less likely to plagiarize anyway, even without an intervention. Additionally, both Passow et al. (2006) and Khalid (2015) provided their own explanations for discrepancies of academically dishonest behaviors among learners of various levels. One general consensus was that student populations as a whole do not stop cheating altogether as they approach graduation, and thus professional status, but that they develop an expertise in cheating, which allows

them to discern which types of cheating are most effective and will less likely be detected (Passow et al., 2006; Khalid, 2015).

Such cheating fluency is of great concern and not without consequences. The college experience should provide the foundation for an ethical career, and institutional failure to ensure ethical graduates, leaves colleges and universities susceptible to questions about the quality of degrees being awarded to their graduates (McCabe et al., 2012). Bowers (1964) stated that, "The person who finds that dishonesty pays off in college, that it brings him what he wants and may not be able to acquire through honest effort, may try it in his occupation and in other activities" (p. 4). This was revealed in his landmark study, which investigated academic dishonesty of more than 5000 students enrolled in 99 institutions (Bowers, 1964, p. 225). This statement holds true today. Students "feel growing pressure to demonstrate high academic achievement" (McCabe et al., 2012, p. 6) and thus may be pressured to cheat to maintain an image of competency and success, even if they view such actions as immoral.

Moral and Ethical Development

Engineering ethics provides a context-specific expansion of ordinary morality (a sense of right and wrong) by providing opportunities to expand upon the behavioral dispositions that students bring into an academic setting (Abaté, 2011; Davis, 2006). This expansion upon ordinary morality often provides an explicit code of ethics within a field, as is seen in engineering and many other professions. A code implies that professionals will follow the herd, so to speak (Abaté, 2011; Davis, 2006). But engineers also must know when to break that code and not follow the herd, in cases where the injunctive

norm, that which is approved within the code (Cialdini et al., 1991) is unethical and veers from the agreed-upon code (Abaté, 2011). Abaté (2011) stated that:

> Whatever else we might wish for our engineering students, we would presumably most desire them to possess and utilize the appropriate conceptual tools to reason their way through such ethical issues and dilemmas as they are likely to face on the job, and ideally, to intelligently decide on a morally appropriate course of action (p. 587).

The classroom provides a safe place to make mistakes, whether they be technical or ethical in nature (Davis, 2006). Teaching of ethics alone is not sufficient to prevent all professional misconduct. Davis went on to say:

> Teaching ethics seldom turns the evil from their course; it cannot protect the thoughtless from doing what they know they should not do, ensure that the well-meaning will not give in to overwhelming pressure, or that choices made long ago by others will not leave only a few morally bad options to choose between (pp. 721-722).

A debate remains as to when and how the code should be embedded into the undergraduate engineering curriculum. One method, the use of micro-insertions, claims that students should be continually exposed to ethics throughout the course of their undergraduate experience in every class (Davis, 2006; Hess & Fore, 2018). Davis (2006) claimed that “Micro-insertion requires neither new courses nor radical changes in existing courses” (p. 717) and that students show an “enhanced appreciation” for this model (p. 723). Alternately, other curricula incorporate generalized courses on ethics or courses focusing on ethics within a specific field. But Kirkman (2017) claimed students

do not arrive in his course of ethics for engineers as “ethical blank slates” (p. 2), often having experiences with internships or co-ops and any ethics curriculum could help to build on those experiences. Very few of these students, even after internships and co-ops, have had formal exposure to ethics instruction, which agrees with Davis (2006) whose survey of undergraduate students taught by around 145 faculty revealed that nearly 68% (2556 respondents) have had no professional or business ethics class (p. 728).

“The ability to reason morally within an ethical framework at a sophisticated level is a skill that requires nurturing and refining throughout one’s life” (Steele, 2016, p. 368), so undergraduate engineering program facilitators cannot expect students to immediately grasp each nuance of this evolving understanding. However, the development of ethics within the undergraduate program itself can be related to the integrity of the classroom experience, one of the first opportunities for students to demonstrate ethical decision-making in a professional environment. In this sense, ethics is measured in units of academic integrity, often using the decision to cheat as the metric.

Williams, Nathanson and Paulhus, (2010) described low conscientiousness as a predictor for cheating, especially in the work location. The authors summarized that this could relate to cheating in an academic setting. On the other hand, “students that see themselves as honest and principled are less likely to cheat” (p. 299), meaning the development of professional ethics above the ordinary morality goes hand in hand with academic honesty in undergraduate students.

Extrinsic Rewards

Extrinsic rewards provide students with outside motivation to complete their work. Using extrinsic rewards to motivate students to complete difficult tasks may enhance the desire to cheat (Jordan, 2001; Lang, 2013). Extrinsic motivation includes pressure from peers and parents, pressure for good grades, and the fear of failure (Anderman & Koenka, 2017; Ip et al., 2016; Jordan, 2001; Lang, 2013). These pressures may cause students to engage in academically dishonest behaviors even if they have the moral understanding to know that cheating is wrong.

Students who pursue higher education find themselves trying to conform to college environment norms. The sense of belonging to a group or an organization on campus adds to the outside pressures. As students find themselves gravitating toward one group of students over another, they may realize how much they have in common with other students and this creates what Miller and colleagues called social comparison (Miller et al., 2017). It is social comparison that creates norms for students to cohere, even if these norms include dishonest behavior.

Depending on how an instructor designs a course and interacts with students, the resulting interchange can further compound the external pressures. If an instructor focuses on the students earning the grade, then students, too, will focus on the grade, no matter how they achieve it. Murdock and Anderman (2006) wrote, “Students who focus on their abilities, social comparison, and extrinsic rewards report increased dishonesty” (p. 132). Furthermore, students who participate in classes with a lot of external rewards cheat more than those in classes where a mastery learning approach (one where students are encouraged to try until they master the content), is employed (Jordan, 2001). The

mastery of content leads to a fuller understanding of the material and builds confidence in the ability to complete the work.

Prior Cheating

Prior cheating is a significant indicator of current cheating habits in pharmacy school. Ip and colleagues (2016) point out, “A history of cheating in undergraduate studies was the only predictor for cheating in pharmacy school” (p. 4). They further point out that “the only predictor in cheating in undergraduate studies was cheating in high school, and the only predictor of cheating in high school was cheating in middle school” (p.4).

In a review of how previous research related to their own, McCabe et al. (2012) made similar conclusions. According to McCabe and colleagues, high school students frequently exhibit cheating behaviors and are exposed to cheating long before college. Additionally, because of changes in student attitude in high school, much like in college, the perceptions of cheating between high school students and their teachers are varied (McCabe et al., 2012). This led McCabe et al. to the conclusion that regarding cheating, “college is not that different from high school after all” (p. 34).

Prevention of Academic Dishonesty

Academic dishonesty is widespread. Some ways to prevent academic dishonesty include pedagogical practices such as the implementation of fair and authentic assessments, engagement of students in the classroom using active learning strategies, allowing students to interact with one another as well as experts from industry, and maintaining a focus on intrinsic motivations instead of extrinsic rewards (Felder & Brent, 2016). Anderman and Koenka (2017) collected a list of questions asked by students

regarding cheating: What is the purpose? How do I do it? What are the costs associated when determining whether or not to cheat? As students focus their efforts toward academic tasks, these questions play out in their minds as they pursue their academic goals. Students are more likely not to cheat if they are interested in mastery of the task, meaning they have intrinsic motivation to complete the task. Moreover, if students have extrinsic motivation (good grades, peer pressure, and fear of failure), then they have a higher tendency to cheat. Additionally, according to Lang (2013), to prevent cheating, modification of the environment, not the learner, will produce fewer cheating behaviors. Environmental change can include adding an academic integrity clause to the syllabus to create a culture of integrity, changing the classroom layout, or changing assessment and pedagogical practices to be more authentic, grounded, and engaging. These strategies should be successful no matter the level of the learner. In addition to environmental changes, adopting pedagogical practices of authentic assessment, activities which keep the learner engaged and active in the course (active learning), and those that provide intrinsic motivation have also shown success in deterring academic dishonesty (Felder & Brent, 2016).

Authentic Assessment

If students are given the social structure and support to strive for mastery using authentic assessment, then students are less likely to conduct dishonest behavior (Anderman & Koenka, 2017). If instructors focus on mastery goals and promote mastery learning, then students would not need to cheat. For example, if a student can work on an assignment until she/he has it right, then the student should not feel the need to cheat to get a good grade. The grade follows the learning of the material in a deeper more

meaningful way. So, what does this environment look like? Anderman and Koenka (2017) stated:

> If students are learning in an environment in which they (a) are encouraged to master the material and (b) have the opportunity to work on various tasks, activities, and assessments until they reach a point of mastery, then cheating serves little purpose and results in minimal benefits". In addition to authentic assessment, grounding your assessments also prevents cheating (p. 98).

Grounded Assessment

Grounded assessments are unique to a specific course during a specific semester. There are four types of grounding: grounding in time, around current events and ideas; grounding in place, often community or classroom-focused; grounding to the individual, making the assessment meaningful to a specific student experience; and interdisciplinary grounding, relating between disciplines in a novel way (Lang, 2013). Though strategies such as grounded assessments may prevent academic dishonesty, they may also increase the amount of up-front effort and planning an instructor needs to put into the course each semester. However, if the current assessment practices and teaching strategies lead to a great deal of cheating, an instructor can modify the structures and/or environment in which the students are cheating (Lang, 2013).

Engagement

Student engagement has been defined "as a process and a product that is experienced on a continuum and results from the synergistic interaction between motivation and active learning" (Barkley, 2010, p. 8). Engagement is the interaction of the student with course material, other students, and with the instructor. Research shows

that students are more engaged when there is a good student-teacher relationship (Conner & Pope, 2013). In their study, Conner and Pope found:

> Fully engaged students achieve significantly higher GPAs, take significantly more advanced courses, cheat significantly less, and experience significantly less academic worry and significantly fewer internalizing, externalizing and physical symptoms of stress compared to other students. (p. 1434)

But they also found in their study that only one third of the participants were fully engaged in coursework (Conner & Pope, 2013). It is the responsibility of the instructor to engage students with the course material, acting more as facilitator than as instructor. Smith and his colleagues (2005) wrote, "In other words, the real challenge in college teaching is not covering the material for the students, it's uncovering the material with the students" (p. 88). If students are engaged in their course work throughout their academic career, then they are ready to take their place in society and become productive citizens. "It is important that when seniors graduate they have developed skills in talking through material with peers, listening with real skill, knowing how to build trust in a working relationship, and providing leadership to group efforts" (Smith et al., 2005, p. 97).

Active Learning

Active learning provides students with opportunities to incorporate prior knowledge with new content to make sense of the information in new ways (Ambrose et al., 2010; Morrison et al., 2013). Because the utilization of active learning strategies in undergraduate classes has been linked to increased performance above traditional lecture, including increases in STEM content areas (Freeman et al., 2014), the use of such

strategies should be viewed positively and incorporated into classrooms across the country (Lucas et al., 2013). Crouch and Mazur (2001) stated that introductory undergraduate "students develop complex reasoning skills most effectively when actively engaged with the material they are studying and have found that cooperative activities are an excellent way to engage students effectively" (p. 970). Additionally, Freeman et al. (2014) determined in their analysis that an increase in "the number of students receiving STEM degrees could be answered, at least in part, by abandoning traditional lecturing in favor of active learning" (p. 8410), to better facilitate long-term mastery of STEM content. This may be attributed to a large amount of forgotten information in situations where students study by rote memorization to pass an exam in an experiential course, rather than striving for a deep understanding of the material (Lucas et al., 2013). Alternately, active learning strategies such as peer instruction, problem-based learning, student-centered active learning, the use of clickers, think-pair-share, and discussion (Obenland et al., 2012; Smith et al., 2005), all require participation in the classroom, help students to learn more deeply, become more responsible for their own learning (Lucas et al., 2013), and thus, active engagement may be responsible for a deeper understanding of professional ethics (Abaté, 2011; Davis, 2006).

According to Freeman et al. (2014) there was no significant difference in response to active learning between majors and non-majors or between lower and upper-level courses, meaning that the benefits of this strategy are widespread. However, Freeman and colleagues (2014) did find statistical significance when comparing class size, where data indicated that "active learning benefitted students in medium (51-110 students) or large (>110 students) class sizes" (p. 8411). A concern related to these findings was presented

by Obenland et al. (2012), in which they stated, “One major difference between active learning approaches in small and large classes is the possibility of students remaining silent in large classes despite the active learning approaches” (p. 91). However, Obenland et al. (2012) went on to determine that though there is a greater likelihood that some students may be silent in a larger class, that those silent students were typically not passive and were involved in the active learning process, which supports the claim by Freeman et al. (2014) that studies need to focus on “second-generation research,” that is, how active learning impacts specific fields and/or populations, and what methods work the best in each as opposed to the study of the effectiveness of active learning in general (p. 8413). When polled, students also showed positive attitudes toward active learning (Cahill et al., 2014; Crouch & Mazur, 2001; Lucas et al., 2013) which may indicate improved motivation to learn.

Though many researchers have provided evidence of the effectiveness of active learning, skepticism remains. Faculty worry that incorporating active learning will take more time than traditional strategies (Lucas et al., 2013) and as previously mentioned, some express concern about replicability across all class sizes, disciplines, and majors (Freeman et al., 2014; Obenland et al., 2012).

Active learning strategies may provide one solution to cheating in academia. According to Tovani (2014):

> Instead of bemoaning the fact that kids cheat, we need to examine our instructional practices to see whether we’re actually driving them to do it. By transforming our instruction to promote more authentic, empowered

> learning, we'll be able to accurately assess students' learning without the distortion that comes from cheating. (p. 53)

Such transformation of instructor preparation is also an active process. "Instructors - like students - go through a process of intellectual development. We might begin at a stage where we are looking for the 'right answer,' the pedagogical magic bullet that will, say, achieve full student participation during classroom discussion" (Ambrose et al., 2010, p. 222). As college faculty develop as teachers, they must consider their own strengths and weaknesses through self-reflection, comparison with colleagues, and active professional development, just as is expected by students who are actively learning in class (Ambrose et al., 2010). This indicates that active teaching is also an active learning experience.

Proactive Approach

Studies also indicate that cheating is reduced when faculty use proactive approaches rather than reactive approaches (Madara & Namango, 2016; Starovoytova & Arimi, 2017). By its very nature, a proactive instructional approach begins with course design, long before students enter the classroom. As previously mentioned, communicating clear student expectations as part of course design (Anderman & Koenka, 2017) will assist in deterring dishonest behavior. When instructors use new strategies such as active learning, they must provide students with clear guidance and expectations of the activity removing any ambiguity, thus preventing the student's need to cheat (Felder & Brent, 2016).

Intrinsic vs. Extrinsic Motivation

Intrinsic motivation is the internal drive to learn or complete an assignment without using external rewards as motivation. Ryan and Deci (2000b) said intrinsic motivation, reflects the primary propensity of organisms to engage in activities "that interest them and, in so doing, help them to learn, develop, and expand their capacities. Intrinsic motivation is entailed whenever people behave for the satisfaction inherent in the behavior itself" (p. 16).

Since the 1970s, many studies have focused on motivation (Sansone & Harackiewicz, 2000), and this early research showed that using extrinsic motivation/rewards caused a negative effect on intrinsic motivation. Although many researchers agreed during that time, society still used extrinsic motivations to reward the intended behavior. Examples include schoolteachers putting a smiley face or stickers on student papers for good work and companies giving bonuses for hard work. These same behaviors continue today.

On the other hand, Eisenberger and Cameron (1996) published an article that contradicted the previous research and stated there was no statistical significance relating extrinsic rewards to diminished intrinsic motivation. In their study, they reviewed two decades of psychology studies which indicated "little evidence that reward reduces intrinsic task interest" (Eisenberger & Cameron, 1996, p. 1162). Though their study did not attempt to specifically address college-level students, an analogous comparison in the college environment can be made. For example, if a student receives a reward, such as bonus points on one exam, but then has no option to receive bonus points on another exam, the student would perform the task with the same effort as they would have without the potential reward (bonus points).

Some researchers use the term autonomous motivation as it relates to self-determination theory (Anderman & Koenka, 2017; Rothes et al., 2017; Ryan & Deci, 2000a, 2000b) to describe what motivates individuals to behave in the ways they do. The notion of autonomous motivation, having control over self-motivation, was studied by Rothes and colleagues (2017). In their study, they found that non-traditional learners are more mastery-oriented and have more intrinsic motivation than the traditional student. Also, adult learners are more engaged and have higher self-efficacy, which means adult learners are more likely not to display academically dishonest behavior (Rothes et al., 2017).

So how does an instructor ensure that students are intrinsically motivated as opposed to extrinsically motivated? Instructors can use formative assessments, quick and often informal assessments, to check for understanding of the learning objectives and focus on mastery of the material (Anderman & Koenka, 2017). Also, adopting cooperative learning "should convey that working together to learn the material deeply is the central goal, rather than working in competition with one another. As a result, cheating under these circumstances should be considerably less enticing" (Anderman & Koenka, 2017, p. 99). One method of extrinsic motivation that may be beneficial is instructor praise. In Eisenberger and Cameron's (1996) study, they found that individuals will spend more time on a task if given verbal praise and the individuals liked the task better after the extrinsic reward.

Deficiencies in Previous Research

Freshman-level undergraduate students were intentionally eliminated from study in early work on academic dishonesty so that students would not self-report on their

experiences from high school (Bowers, 1964; McCabe & Trevino, 1993). Early studies also neglected to distinguish between specific engineering disciplines. These factors leave a gap in the current knowledge about the levels of dishonesty by undergraduate students early in the college experience as well as those who are of differing engineering majors. Additionally, those same early studies were conducted before technology and online learning pedagogy had become prevalent in higher education. As a result, surveys that ask additional questions about the technology-enhanced classroom need to be developed to provide a more comprehensive picture of academic dishonesty in the current learning ecosystem, which is a more intricate collection of environments than the traditional face-to-face classroom. Finally, though it was included within some articles, the literature portrayed past cheating as a secondary concern because it was not indicated in many literature titles. This results in the need for additional research relating the relationships between prior and current academic dishonesty.

Significance: Engineering vs. Other Fields

The goal of assessment is to measure specific achievement goals. When the reliability of such measures is compromised by dishonesty, not only does the validity of student learning come into question, but the instructor's ability to diagnose gaps in knowledge is also affected (Passow et al., 2006), which can become an important factor for measuring institutional accreditation standards. When students falsely appear to meet standards through dishonest methods, institutions are put at risk of losing accreditation. Additionally, because academic honesty in engineering programs has received greater attention during a nationwide emphasis on teaching professional ethics as a part of engineering curricula (Passow et al., 2006), there is increased pressure on universities to

guarantee that graduating students understand professional engineering ethics. The path to this understanding of professional ethics begins with understanding academic honesty within the engineering curriculum. However, the very nature of an engineering curriculum also lends itself to provide many forms of assessment which are easy for students to manipulate in dishonest ways (Khalid, 2015).

Khalid described several anecdotal accounts of dishonest assessment practices by students. Of the practices reported by faculty, three could easily be related to the types of assessments typical in an engineering curriculum: cheating on exams; cheating on homework; and misuse of calculators. Though not isolated to engineering, the three methods described by Khalid are worthy of discussion as each relates to engineering.

First, cheating on exams is common in quantitative courses involving calculations and mathematical analysis (Khalid, 2015), and has been studied specifically as applied to engineering students (Bowers, 1964; Carpenter et al., 2010; Harding et al., 2007; Passow et al., 2006). But, because math is a necessity of any engineering curriculum, the removal of such quantitative components is not feasible. This is just one example of how the engineering curriculum itself may lead to an enhanced desire to cheat (Carpenter et al., 2010). Second, deliberate practice (Ambrose et al., 2010) is an essential component of the learning process. Deliberate practice for engineering students often includes the completion of homework assignments and problem sets. Instructors must provide sufficient opportunities for practice and often those assignments are graded to motivate students to complete the practice. However, students may approach graded homework as a task instead of a learning opportunity, and thus feel the need to cheat on homework that is either difficult to complete or which takes more time than the student is willing to

invest, even if the reason for the task is to prepare the student for future assessment through targeted and deliberate practice. Third, calculators are necessary in engineering courses which require advanced and complex calculation procedures. When an instructor is tasked with assessing the students' ability to apply complex skills, it is often not feasible for students to complete all calculations by hand during timed assessments, thus the need to allow calculators. The need for high-tech calculators, though, also introduces the opportunity for storage of data which may be used to assist with dishonesty during assessments. Though fields other than engineering also exhibit academic dishonesty, the reasons mentioned above may provide some explanation about the higher rates seen within engineering programs upon repeated comparison to programs in other disciplines (Bowers, 1964; Carpenter et al., 2010; McCabe et al., 2012; Passow et al., 2006).

Summary

Discrepancies in the perceptions of and descriptions /definitions of academic integrity among students of various levels of professional maturity and faculty on an engineering campus may lead to increased rates of academic dishonesty. Many instructors overlook the necessity to explicitly define academic dishonesty for their students (Carpenter et al., 2006). Because existing definitions have traditionally varied (McCabe et al., 2012), a lack of specific contextual descriptions in each classroom may contribute to a higher rate of dishonesty. Additionally, the online and technology-enhanced classrooms may provide different concerns altogether.

To combat academically dishonest behavior, institutions provide students with a basic definition of what constitutes dishonesty and instill a student ethical honor code. Additionally, pedagogical practices by each instructor, such as the implementation of fair

and authentic assessments, engagement of students in the classroom using active learning strategies, allowing students to interact with one another as well as experts from industry, and maintaining a focus on intrinsic motivations instead of extrinsic rewards may decrease dishonesty (Felder & Brent, 2016; Jordan, 2001; Lang, 2013). This is especially important in engineering programs, which have among the highest rates of student-reported academic dishonesty (Bowers, 1964; McCabe & Trevino, 1993; McCabe et al., 2012) and which rely on the understanding of a professional code of ethics (Abaté, 2011; Davis, 2006).

Students on a campus with a strong culture of ethics still report levels of cheating which could negatively impact the integrity of the school. These instances of academic dishonesty may be attributed to any number of reasons, but one likely culprit is the relationships among a student's attitude, perceived behavioral control, and descriptive environmental norms, all described in the theory of planned behavior (Ajzen, 1991). The theory of planned behavior relates the attitude toward a specific behavior, the subjective norm of the behavior in a specific population, and the perceived control by the subject over the behavior. According to this theory, the choice to cheat is influenced by the interaction of these three factors (Ajzen, 1991). When provided with the appropriate resources, students who enter the classroom with honest intentions will likely avoid cheating.

Three major deficiencies have been identified in the current literature. First, early studies (Bowers, 1964; McCabe & Trevino, 1993) intentionally did not collect data from freshman-level students. Second, studies have also neglected to incorporate questions about academic dishonesty that specifically relate to the technologically enhanced or

fully online classroom. Coupling the types of questions asked in early studies by Bowers (1964) and McCabe and Trevino (1993) with technology-focused questions along with including freshman-level students but polling them toward the end of their first and second semester would provide a more comprehensive view of academic dishonesty for college students. Third, previous studies have focused on engineering students as a whole and not specific disciplines within the field of engineering.

Dishonesty in the classroom puts the reputation of the students, instructors, and the institution at risk. However, the significance of the current study extends beyond the classroom environment. In engineering, dishonesty that continues past graduation and into the profession can have dangerous safety consequences. Students must learn to become successful practicing engineers by correctly calculating and analyzing complex problems as well as developing an understanding of and appreciation for the engineering code of ethics.

Chapter 3 Methodology

Chapter 3 is an overview of the research design including the definition of and rationale for the selection of a mixed methods approach. It describes Phase 1, the quantitative phase, and Phase 2, the qualitative phase methodology. It also includes the statistical measures used for analysis of each data set.

Four research hypotheses, which are in alignment with each of the four components of the overarching research questions, are presented. The development of hypotheses, selection of variables, and methods of data collection were influenced by the research setting and participant selection. Potential negative implications due to human subject research were addressed in the IRB approval at the home institution of the researchers as well as the university at which the survey was conducted, which are both part of the same university system.

Purpose

An explanatory sequential mixed methods study was used to explain how course pedagogical practices and attitudes of students of various academic levels (freshman/sophomore and senior) relate to academic dishonesty. The design was developed to determine the discrepancies in the perceptions of and descriptions /definitions of academic dishonesty among students of various levels of professional maturity and among faculty on an engineering campus. The design allowed for the collection of cross-sectional, web-based, quantitative survey data from engineering students and the instructors who taught those students. Additionally, instructors were surveyed for the courses in the sequence which connects the two courses under study: introduction to engineering design and senior design. The survey determined student

attitudes, intentions and actions as well as instructor perceptions of the same characteristics as reflected through the theory of planned behavior. Qualitative data obtained through interviews of the engineering faculty was used to enrich the quantitative data. For the purpose of this study the terms faculty and instructors were used interchangeably.

Research Design

Researchers who design mixed methods studies must fully understand both the quantitative and qualitative aspects of the investigation including the use of theory, methodologies, and statistics as well as how the approaches of the quantitative and qualitative portions of the study may differ. Mixed methods research oftentimes uses a pragmatic approach in which researchers may use varied strategies for collecting and analyzing data (Creswell, 2014).

It was determined that neither quantitative nor qualitative research alone could provide a complete response to the questions about the influence of pedagogical practices on behaviors, attitudes, and perceptions of academic dishonesty. Therefore, a mixed methods approach was used. Quantitative data from a survey of engineering students and the instructors who teach them is placed in juxtaposition with the interpretation of quantitative subjective experiences from qualitative instructor interviews to provide the best understanding of academic dishonesty within the sample population.

Phase 1 was designed to measured instructor perception of student attitudes toward academic dishonesty; and those rates of instructor-perceived dishonesty were compared to the actual self-reported rates of student dishonesty. The attitudes and rates of dishonesty reported by students of various academic levels (freshman/sophomore and

senior) was measured using a three-section questionnaire (see Appendices A and B). The survey was administered to 314 students (259 freshman/sophomores; 55 seniors). A total of 259 students (82.5%) responded to the survey. Of those, 207 (79.9%) were freshman/sophomore participants and 52 (20.1%) were seniors. There were 53 (25.6%) who did not submit the survey and two students (<1%) did not consent. From the respondents, the freshman/sophomore responses were narrowed to only those who intended to declare a major of civil, architectural, or environmental engineering (*n*=31; 45.2% male, 54.8% female). Because the seniors were all within the desired majors, all 52 (61.8% male, 32.7% female) remained in the sample.

An explanation of the quantitative findings was constructed based on the qualitative data collected during Phase 2. The qualitative Phase 2 component included results from interviews of the engineering instructors who taught the students surveyed during Phase 1 in order to determine instructor descriptions of and perceived rates of cheating within their classes. See Table 1 for a visual model of the research design.

Table 1

Visual Model for Explanatory Sequential Mixed Methods Procedures

Phase	Procedure	Product
Phase 1 Part A: Quantitative data collection, student data	Cross-sectional, web-based survey administered in a face-to-face environment	Numerical data
Phase 1 Part B: Quantitative data collection, instructor data	Cross-sectional, web-based survey administered in a face-to-face environment	Numerical data
Quantitative data analysis	Mean, median, mode, Cronbach's alpha, Wilcoxon Rank Sum test	Interpretation of descriptive and inferential statistics

Table 1

Visual Model for Explanatory Sequential Mixed Methods Procedures

Phase 2: Qualitative instructor interview	Semi-structured, face-to-face interviews with 6 instructor participants	Recorded, written, and/or typed documentation
Phase	Procedure	Product
Qualitative data analysis	Thematic analysis, across-case theme development to include: mean, median, mode, Wilcoxon Rank Sum test	Themes, similarities and differences among themes, coding of individual responses, identification of trends in responses, visual representation of data
Interpretation of analyses	Analysis among all survey components and interview results	Discussion of results, recommendations for future research

Research Questions

The overarching research questions were the following.

- **Research Question 1 (RQ1):** What are the self-reported rates of dishonesty by undergraduate engineering students of various academic levels (freshman/sophomore and senior)?
- **Research Question 2 (RQ2):** What are the differences in perceptions of and descriptions of academic dishonesty between faculty and engineering students?
- **Research Question 3 (RQ3):** What relationships exist between dishonest choices made by students and the theory of planned behavior?
- **Research Question 4 (RQ4):** To what degree do pedagogical strategies correlate to the rates of dishonesty reported by students?

Quantitative Questions

The quantitative phase compared student and instructor perceptions in order to describe the culture of integrity on campus as related to the theory of planned behavior. The subject variables of the study were the student academic level and the use of various pedagogical practices by instructors. These subject variables were compared to the dependent variables of self-reported rates of cheating and student attitudes toward cheating using the theory of planned behavior (Ajzen, 1991).

A survey (see Appendix A) was developed to determine which behaviors engineering students at various academic levels would define as academically dishonest and which dishonest behaviors would be reported most frequently by engineering students of various academic levels. The student survey was also used to measure differences between the self-reported acts of dishonesty as well as attitudes toward those actions for students of various academic levels (freshman/sophomore and senior). The resulting data was used to determine relationships between student academic level and self-reported academic dishonesty. See Table 2 for a visual model of the comparisons between student populations and data alignment with the research questions.

Table 2

A Visual Model for Comparisons Between Students (Freshman/Sophomore and Senior)

Survey Topic	Research Question Alignment for Student Survey
Measure of personal ethics	Data validation/internal consistency reliability
	RQ2: perceptions
	RQ3: student attitudes
Descriptions of academically dishonest behavior	RQ3: student attitudes
Ease of dishonesty in this class	RQ2: perceptions of dishonesty

Table 2

A Visual Model for Comparisons Between Students (Freshman/Sophomore and Senior)

Survey Topic	Research Question Alignment for Student Survey
	RQ3: student attitudes, intentions, descriptive norm, and behavioral control RQ4 alignment with pedagogical strategies
Attempts of dishonesty	RQ1: rates of academic dishonesty
	RQ3: student attitudes, intentions, descriptive norm, behavioral control RQ4: alignment with pedagogical strategies
Perceptions of dishonesty	RQ2: perceptions of dishonesty
	RQ3: student attitudes and perceived descriptive norm

A second survey was administered to faculty to identify specific behaviors that they defined as academically dishonest in order to provide a more explicit description of academic dishonesty (see Appendix B). Thirteen faculty and teaching assistants who taught required courses within civil, architectural, and environmental engineering were asked to complete the survey. Six faculty (46.2%) agreed to participate in the quantitative survey and a qualitative follow-up interview. Two faculty (33.3%) were female and four (66.7%) were male.

The behaviors reported in the student survey compared to the descriptions provided by faculty participants to determine discrepancies in the descriptions of and rates of academic dishonesty between faculty and students. The survey also asked the faculty to predict how frequently they perceived each dishonest behavior occurred within the general student population to determine discrepancies in the perceived descriptive

norm of cheating behaviors between students and faculty. See Table 3 for a visual model of the measure of faculty perceptions and data alignment with the research questions.

Table 3

A Visual Model of Faculty Perceptions

Survey Topic	Research Question Alignment for Faculty Survey
Measure of student ethics	Data validation/internal consistency reliability; RQ2: faculty perceptions
Descriptions of academically dishonest behavior	RQ2: faculty perceptions
Ease of dishonesty in this class	RQ2: faculty perceptions
	RQ4: alignment with pedagogical strategies
Attempts of dishonesty	RQ1: rates of academic dishonesty
	RQ2: perceptions by faculty
	RQ3: student behavior, descriptive norm
	RQ4: alignment with pedagogical strategies
Perceptions of dishonesty	RQ2: faculty perceptions
	RQ3: perceived descriptive norm

Qualitative Questions

Instructor interviews using a qualitative instrument (see Appendix C) were conducted after the instructor surveys to further explain the quantitative findings. Specifically, the interviews determined how faculty use pedagogical practices to engage students during class and how those practices relate to student attitudes toward dishonesty and decisions to act dishonestly. Faculty were prompted to describe the roles of various assessment strategies in the classes being studied. Faculty were also asked to define active learning and its role in the class as well as the effect of student engagement on student academic honesty.

Hypotheses

There were several null hypotheses based on the research questions.

- **Hypothesis 1 ($H_0$1):** There would be no statistically significant differences between student groups in the reporting of their level of personal ethics and/or their self-reported rates of academic dishonesty.
- **Hypothesis 2 ($H_0$2):** There would be no statistically significant differences between the self-reported rates of academic dishonesty by undergraduate engineering students and the perceived rates of dishonesty by the faculty who taught them.
- **Hypothesis 3 ($H_0$3):** There would be no statistically significant relationship between engineering students' dishonest behaviors and their attitudes, perceptions, and descriptive cultural norms of such behaviors.
- **Hypothesis 4 ($H_0$4):** Pedagogical strategies would not influence the rates of self-reported academic dishonesty by undergraduate engineering students with statistical significance.

Setting and Participants

The study was conducted at a science, technology, engineering and mathematics (STEM)-focused, Mid-western, public university that is part of a four-campus university system. According to Institutional Data (2020), most students (83%) permanently reside within the state of Missouri and approximately 54% of the student population lives off-campus or commutes to campus. The sample population was undergraduate engineering students enrolled in two classes, a freshman/sophomore-level class for all engineering majors and a civil, architectural and environmental engineering senior-level class. The

first course is typically taken by freshman or first semester sophomores. In order to prevent first-semester freshman from reporting past cheating behaviors from their high school experiences and to encourage only the reporting of cheating in college, students were not surveyed until after the 12th week of class and students were asked to report only on experiences of cheating in college during the current semester. The majors of the students were identified in the freshman/sophomore-level class participants by selecting only the intended civil, architectural and environmental engineering majors. The total number of students present in class was 259 and 207 responses (79.9%) were collected. Of the respondents, 34 students identified as majoring or intending to major in civil, architectural, or environmental engineering or some combination of the three. One respondent who reported being less than 18 years old was removed from this sample. Another student who reported junior status and one who reported being a senior were also removed to leave a sample of 31 of the total 259 students (11.9%) for analysis. It is important to note that the 31 respondents in the freshman/sophomore class represent 11.9% of the three classes surveyed.

A fourth section of the class was also to be surveyed, but an unexpected winter weather event and subsequent campus closure prevented the researchers from conducting the survey. The survey was designed to be collected toward the end of the semester, specifically to prevent freshman students from reporting on cheating in high school. The instructor had chosen the final day of lecture for the survey so there was not a time to survey the remaining students during lecture. The four class sections were also mixed in the lab, so targeting the fourth lecture section within the lab classes would not have been feasible. Additionally, the instructor believed that students might have been under more

pressure to complete their final design project after missing the last lecture class so taking additional time to present the survey may have been detrimental to the students. It was also determined that providing the survey link to students outside of the classroom would introduce undesirable confounding variables.

The senior design course selected for study, one of the last classes seniors take before graduation, is taken in the last semester as an undergraduate and is only offered to those within a civil, architectural and environmental engineering (CArE) major. Fifty-one students were present in class for the survey and four distance students were participating in the live stream of the class. A total of 52 students (94.5%) from the senior design class chose to participate in the survey.

The instructors for each of these courses were also surveyed. In addition to these instructors, additional instructors teaching the classes in the engineering sequence that connects these two classes (introduction to engineering design, applied engineering statics, mechanics of materials, senior design) were surveyed. A total of 13 instructors, including faculty and teaching assistants, were invited to participate in the study. Six faculty (46.1%) in the population agreed to complete the survey and participate in the interview. None of the teaching assistants responded to the request for the study. The faculty completed the survey and then participated in the interview immediately afterward.

Phase 1, the quantitative phase, surveyed all students in two classes in a CArE sequence, less any students who opted out of the survey. The survey population consisted of first and second-semester freshman/first-semester sophomores and seniors depending on the selected course. This procedure was selected to gain a large sample size for the

overall study and to provide data at various stages of the civil engineering course sequence. The survey was piloted in late spring of 2019 and was fully distributed in the fall of 2019.

The lecture classes surveyed were freshman/sophomore-level introductory engineering design course (maximum 450 students/semester) and the senior design course containing civil, architectural, and environmental engineers (maximum 250 students/semester). The sample size was 83 student respondents for the fall semester of 2019. The introduction to engineering design students were surveyed, but only those students who have or intend to declare a CArE major were analyzed. In a typical semester, these majors represent roughly 14% of the engineering population on campus. During the 2019 fall semester, there were 445 undergraduate students, 64% male and 36% female, in the Civil, Architectural and Environmental Engineering department (Registrar, 2019) so the total sample size of 83 represents approximately 19% of the student population in the department.

The two instructors of these courses completed Phase 1 Part B of the quantitative survey (see Appendix B). Researchers also surveyed instructors for the sequence of classes that connects the two studied courses, for a total of four additional instructors. This was done to further explain the changes that occur in faculty perceptions of student attitudes and behaviors as students progress from freshman/sophomore level to senior level.

Phase 2, the qualitative phase, involved personal interviews of the instructors (n = 6) of the selected sequence of courses. To prevent duplication of data, the instructor

interviews were not conducted during the pilot study and were only conducted with the full implementation of the survey in the fall semester of 2019.

Methods of Data Collection

Many of the questions in the surveys of both instructors and students were replicated from previous studies. McCabe and Trevino (1993) adapted and enhanced the survey questions created by Bowers (1964). The self-reported instances measured by McCabe and Trevino provided internal consistency using Cronbach's alpha (r=0.794) (p. 529). Additionally, each of the 12 cheating behaviors was evaluated using the test and non-test cheating components as separate dependent variables (McCabe & Trevino, 1993). The enhanced survey was used multiple times throughout the 1990's and 2000's to study academic dishonesty as it related to the presence of honor codes within specific institutions (McCabe et al., 2012). Because the survey questions were not specific to schools with honor codes and instead only asked about specific cheating behaviors, they were appropriate for use in the study. However, because of the increases in available learning technologies and distance and online education since the adaptation of the survey, additional questions related to technology-facilitated learning were developed.

Reliability and validity verification of the newly created questions within the context of a survey which includes the existing questions was conducted. Face validity of the updated instruments was established through a review by six faculty at two different universities, from both the humanities (including communications) and STEM fields.

A pilot study of students and faculty was conducted in the spring semester of 2019. The pilot was conducted with faculty and students at the focus university, but in departments other than engineering except for the CArE graduating seniors. Feedback

from student participants led to modification of some questions on the survey instrument. Students were unclear of the meaning of "padding" a bibliography and they described some classes where crib notes were allowed on exams. The initial question did not distinguish between authorized and unauthorized crib notes. The survey was updated to define padding and to include only the use of unauthorized crib notes within the final instrument question. To validate the changes, a second pilot was conducted in the summer semester of 2019 (see Appendices A and B for the final versions of instruments).

Phase 1 (Quantitative)

The cross-sectional survey had two phases. The first phase had two parts, Part A for students in the surveyed classes and Part B for the instructors teaching those classes and other instructors in the CArE sequence. The questionnaire asked for responses using multiple choice questions by asking for participants to provide one answer or to indicate "*all that apply*" on a five-point Likert scale, or to choose a "*yes*" or "*no*" response to dichotomous questions (see Appendices A and B).

Phase 1 Part A focused on student self-reported rates of specific behaviors defined by the researchers as dishonest. The questionnaire had three sections. The first section consisted of participant demographics; the second section consisted of questions that pertained to the descriptions/definitions of dishonest behavior; and the third section focused on student attitudes, intentions and actions as related to the theory of planned behavior.

Part B of the quantitative survey focused on instructors in the CArE sequence and had the same three sections as Part A. The first section consisted of participant demographics; the second section consisted of questions that pertain to the descriptions

/definitions of dishonest behavior; and the third section focused on perception of attitudes, intentions and actions, as related to the theory of planned behavior (see Appendix B).

Phase 2 (Qualitative)

Phase 2 consisted of interviews of instructors who taught the two courses studied. Four additional instructors in the CArE sequence, which connects the two classes of students being studied, were interviewed, for a total of six instructors. The instructor interview had two components. The first component focused on career information and the second focused on course pedagogical practices typically used by that instructor (see Appendix C).

Variables

Phase 1 asked students to report on instances of specific behaviors which were defined by the researchers as academically dishonest and asked instructors to report on their perceptions of those same behaviors. The definitions were partially based on the work of Bowers (1964) and McCabe and Trevino (1993), in relation to the theory of planned behavior (Ajzen, 1991) (Table 4). The questions measured how pedagogical practices by instructors and attitudes of students at various academic levels related to academically dishonest behaviors. For this phase, pedagogical practices by instructors and student level were subject variables and measures of academic dishonesty and related attitudes were the dependent variables.

Table 4

Academically Dishonest Behaviors Defined in the Study

	Behavior
1	Copying a few sentences of material without proper citation in a paper
2	Included resources, not reviewed or used, on a bibliography
3	Plagiarizing from public material on papers
4	Getting questions or answers from someone who has already taken the exam
5	Copying from another student on a test or exam
6	Working on the same homework with several students when the teacher does not allow it
7	Turning in papers done entirely or in part by other students
8	Giving answers to other students during an exam
9	Using unauthorized crib notes during an exam
10	Using unauthorized digital/online resources during a test or exam
11	Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects
12	Purchasing homework, essays, papers, etc. from online sources to submit as their own

Note. 1= "*not dishonest"* to 4= "*very dishonest*".

To ensure reliability, instructions were standardized across all distributions of the survey and the survey was piloted before implementation to assess the questions for clarity. The surveys were distributed in the classroom environment, which was similar for each class, thus limiting variability of administration and understanding.

Validity of the results was considered. The cheating behaviors posed a threat to content validity because, based on previous studies (Bowers, 1964; McCabe & Trevino, 1993), the behaviors defined as cheating by the researchers represent some of the most common forms of cheating, but they were not all-inclusive with regard to possible cheating behaviors. However, the chosen behaviors were aligned with the behaviors

studied by Bowers (1964) and McCabe and Trevino (1993), with the addition of questions related to the technology-enhanced classroom (see Table 4).

During Phase 2 of the study, a team of one interviewer and one observer was established for each of the six faculty interviews. The interviewer asked questions, guided conversation toward an emic view of the situation, and took notes of interest while the observer recorded a video of the interview, took notes of interest, and documented body language, other non-verbal cues, and any discrepancies or differences which arose to prevent data loss in post-interview transcription. Saturation of data was defined at the point in the interview when the interviewee had exhausted recall of cheating instances and repeated interventions that had already been discussed.

Upon completion of the interviews, themes related to learner engagement such as, active learning, authentic assessment, and intrinsic motivation were interpreted to develop a model for pedagogical practices which reduce cheating for the different academic levels. The pedagogical practices model was compared to the student-reported rates of dishonesty and attitudes toward cheating.

Data Analysis

Analysis of the quantitative portion of the study included descriptive statistics as well as a non-parametric Wilcoxon Rank Sum test because of the small sample size of the faculty population ($\alpha=0.05$). A two-tailed, independent t-test (freshmen/sophomore to senior) to compare the student responses in the two classes on each part of the survey was also conducted ($\alpha=0.05$). Any student data comparisons with data that did not exhibit normal distribution was analyzed using the same non-parametric measures as the faculty data, the Wilcoxon Rank Sum test ($\alpha=0.05$). In addition, student perceptions of

academically dishonest behavior to instructor perception of academically dishonest behavior were compared (α=0.05). Refer to Table 5 for a visual model of the quantitative data analysis done using SAS University Edition (Version 9.4). The qualitative analysis included a review of transcripts and coding of responses to identify similarities and themes for further interpretation and presentation using visuals such as graphs or charts. Some themes related to pedagogical practices include active learning, assessment techniques, and student engagement as well as traditional approaches to teaching. The themes allowed for interpretational analysis of the quantitative data.

Inferential Statistics

The two student datasets were sufficiently large to compare using *t*-tests, even with data that were not normal in distribution (Cody, 2016). However, because the faculty response pool was only six participants, a nonparametric test was chosen for all data that were not normally distributed, even when comparing to the larger population of student responses. SAS University Edition (Version 9.4) was used to run tests for normality and the Wilcoxon Rank Sum test was used to compare all single response groups while the Wilcoxon Signed Rank test was used for paired tests. These particular tests were chosen because data were nonparametric in nature, the Likert-style responses were categorical, and the faculty pool was small (Cody, 2016).

Faculty Interviews

Faculty interviews were designed to help explain the survey results. Specifically, faculty were asked questions about the use of and frequency of various pedagogical practices, assessment styles, active learning, student engagement, measures to prevent dishonesty, student intentions, and culture. Each of the six faculty who were surveyed

also participated in an interview. All faculty interviews were digitally recorded and transcribed. Interviews were then coded, and a thematic analysis revealed trends in the qualitative data. The trends were used to help explain the quantitative results (see Results and Analysis section for descriptions of qualitative themes).

Table 5

Visual Model for Quantitative Data Analysis

Measure of personal ethics			
Population (Pop)	Instrument/Question		Statistical Measures
	Student	Faculty	
Freshman/Sophomore	7,14	-	Cronbach's alpha, Wilcoxon Rank Sum, Wilcoxon Signed Rank
Senior	7,14	-	Cronbach's alpha, Wilcoxon Rank Sum, Wilcoxon Signed Rank
All Students	7,14	-	Cronbach's alpha, Wilcoxon Rank Sum
Faculty	-	8, 14	Cronbach's alpha, Wilcoxon Rank Sum

Descriptions of academically dishonest behavior				
Pop 1	Pop 2	Instrument/Question		Statistical Measure
		Student	Faculty	
Freshman/Sophomore	Senior	9.1-9.12	-	Wilcoxon Rank Sum
Freshman/Sophomore	Faculty	9.1-9.12	10.1-10.12	Wilcoxon Rank Sum
Senior	Faculty	9.1-9.12	10.1-10.12	Wilcoxon Rank Sum
All Students	Faculty	9.1-9.12	10.1-10.12	Wilcoxon Rank Sum

Ease of academic dishonesty in this class				
Pop 1	Pop 2	Instrument/Question		Statistical Measure
		Student	Faculty	
Freshman/Sophomore	Senior	11.1-11.12	-	Wilcoxon Rank Sum
Freshman/Sophomore	Faculty	11.1-11.12	12.1-12.12	Wilcoxon Rank Sum
Senior	Faculty	11.1-11.12	12.1-12.12	Wilcoxon Rank Sum
All Students	Faculty	11.1-11.12	12.1-12.12	Wilcoxon Rank Sum

Table 5

Visual Model for Quantitative Data Analysis

Attempts of academic dishonesty in this class				
Pop 1	Pop 2	Instrument/Question		Statistical Measure
		Student	Faculty	
Freshman/Sophomore	Senior	12.1-12.12	-	Wilcoxon Rank Sum
Freshman/Sophomore	Faculty	12.1-12.12	7.1-7.12	Wilcoxon Rank Sum
Senior	Faculty	12.1-12.12	7.1-7.12	Wilcoxon Rank Sum
All Students	Faculty	12.1-12.12	7.1-7.12	Wilcoxon Rank Sum

Perceptions of typical academic dishonesty				
Pop 1	Pop 2	Instrument/Question		Statistical Measure
		Student	Faculty	
Freshman/Sophomore	Senior	13.1-13.12	13.1-13.12	Wilcoxon Rank Sum
Freshman/Sophomore	Faculty	13.1-13.12	13.1-13.12	Wilcoxon Rank Sum
Senior	Faculty	13.1-13.12	13.1-13.12	Wilcoxon Rank Sum
All Students	Faculty	13.1-13.12	13.1-13.12	Wilcoxon Rank Sum

Attempts of academic dishonesty vs. perceptions		
Population	Question (Student Instrument)	Statistical Measure
Freshman/Sophomore	12.1-12.12,13.1-13.12	Wilcoxon Rank Sum
Senior	12.1-12.12,13.1-13.12	Wilcoxon Rank Sum

Note. Questions 9, 11-13 on the student instrument included 12 sub questions, as did questions 10, 12, and 13 on the faculty instrument. Sub questions are indicated by decimals (e.g. "*9.1-9.12*" refers to questions 9.1, 9.2, 9.3, and so on). (See Appendices A and B for quantitative instruments).

Internal Validity

Phase 1: The sampling method used in the research design created a selection threat to internal validity, specifically regarding the faculty participants because of the small sample size (n=6). The research participants included the entire population of learners within the two specified courses as well as all instructors who taught the courses and the courses in the series which connects the two courses. This helped to reduce the potential for sampling errors. All instructors were willing to participate in the study and to allow the researchers to administer the survey to every student in each class. A total of

314 student surveys were administered during class time. Instructors stepped out of the classroom during the student survey. Additionally, the two faculty who taught the students who were surveyed as well as four additional faculty participated in a survey and follow-up interview during a time that was convenient for them. Though the instructors who were invited to participate included both faculty and teaching assistants, all respondents were faculty (*n*=6).

There was one potential threat related to the sample sizes. Because the two courses under investigation were taught by only two instructors, the instructor descriptions of and perceptions of the rates of cheating are not generalizable beyond their own classes. To reduce this threat, the instructors who taught the courses within the sequence which connects the freshman/sophomore-level course to the senior-level course, six instructors in total, were also surveyed and interviewed. This helps to support generalizability of the data across the civil, architectural, and environmental engineering majors at the institution.

The sampling method could also have introduced an added threat to internal validity. The study focused on sampling from two courses within a civil, architectural, and environmental engineering sequence. However, the lower-level course was a large-enrollment course which included students from multiple other engineering disciplines who had not yet declared a major. To address this selection threat, students were asked to identify their intended major and only survey data from students who intend to major in civil, architectural, and environmental engineering were used for comparison (*n*=31). The introductory class was chosen because it is the only required engineering course for CArE which is taken during the freshman or sophomore year. In order to avoid a measure

of academic dishonesty in high school, previous researchers avoided the survey of freshman-level students (Bowers, 1964; McCabe & Trevino, 1993). The research design included data from students who reported that they were in the first semester of their freshman year. However, the data was collected after the 12th week of their first semester of college, which allowed for reporting of dishonest behaviors based on college experience. Students were also asked to report only on behaviors during that academic semester and only within the classes being studied.

Due to sample size, generalization of the quantitative findings to engineering degree programs other than those within CArE and generalization to an institutional level is considered a limitation of the study. Also, because the two courses studied were offered in a face-to-face environment, the findings are not generalizable to the online classroom environment, even though assessments within the courses may make use of technological components.

Phase 2: The qualitative interview included all instructors who taught the two courses in which students were surveyed as well as four instructors who taught the courses in the sequence which connects these two courses. Because of the small sample size of this population, generalizability of the results across all engineering instructors is not possible. The information collected from the instructor interviews was used in an attempt to explain the survey data collected from the students within their classes and how it related to the perceived rates of cheating as reported by the same instructors during Phase 1.

Interview questions were taken from established measures and some were created in advance of the actual study. Each interview was conducted by the same team of two

researchers to ensure consistency in questioning. Additionally, the interviews were recorded using audio, video, and handwritten or typed notes.

Ethics and Human Relations

Potential threats to the study participants were carefully evaluated. Specifically, student participants may have feared retaliation if instructors or administrators were able to identify them based on their comments. To alleviate this, student data was collected anonymously, and individual responses were not shared with instructors or administrators. Instructors were also asked to leave the room during student data collection. Additionally, instructors whose classes were being surveyed may suffer consequences if the data indicated that cheating is rampant in their classes. The department chair, who serves as the evaluator for teaching effectiveness was receptive to the study, which served as a safeguard for preventing negative consequences for instructors. Faculty were further assured by access to existing instructor support programs as well as new interventions which might be implemented to address any academic dishonesty revealed by the study.

Researchers discussed the study with the department chair and each instructor participant. The design was also discussed with the Vice Provost for Academic Support, who supports instructors across campus in all instances of undergraduate academic dishonesty. All instructors were very supportive of the study and were willing to allow the survey/interview. The study also received IRB approval at the home institution of the researchers as well as the university at which the survey was conducted, which are both part of the same university system.

The data collection process was discussed with the course instructors and the department chair, who agreed to collaborate. The data collection model included a short informed-consent prompt contained within the survey instrument and reviewed during the interviews. Survey respondents used Qualtrics to complete the anonymous online survey in the classroom (students) and just before the interview (faculty). Both researchers were present during the survey/interview to provide explicit instructions to ensure confidentiality while encouraging nearly 100% response rate on the online survey in Phase 1 from both students and instructors.

Summary

A sequential, explanatory mixed-methods design was appropriate for collecting the data to answer the research questions posed. The design was divided into two phases, the first of which included a separate component for both students and faculty. Phase 1 Part A was a quantitative survey to gather student self-reported rates and perceptions of academic dishonesty. Phase 1 Part B quantitatively collected data related to faculty perceptions of academic dishonesty. The qualitative faculty interview which followed during Phase 2 helped explain the rates of dishonesty and perceptions collected during the Phase 1 quantitative surveys.

The analysis of the quantitative phase revealed the relationships between the rates of academic dishonesty by undergraduate engineering students and the perceptions of the students as well as the faculty who teach them. The perceptions of dishonest behaviors were also aligned with the theory of planned behavior to determine whether student attitude indicated the presence of a subjective descriptive norm of dishonest behaviors in the classroom environment. The qualitative analysis helped the researchers understand

the quantitative data by revealing specific pedagogical strategies used in each class and aligning those strategies with the self-reported rates of academic dishonesty. The alignment was further strengthened with a comparison among various pedagogical strategies used by faculty and specific strategies were identified that may serve as predictors of academic dishonesty. The comparison to pedagogical strategies was also evaluated in relation to the theory of planned behavior as it relates to the perceived behavioral control over the student choice to act dishonestly.

Chapter 4: Results

Previous studies measuring academic dishonesty of undergraduate students did not collect data about the dishonest behaviors of freshman-level students. When focusing on engineering majors, those studies also neglected to distinguish between specific engineering disciplines (Bowers, 1964; McCabe & Trevino, 1993). Additionally, because of technological advancements in the field of education, more research is needed to investigate the use of technology to both enable and hinder student academic dishonesty. The lack of understanding of the roots of academic dishonesty occurring early in the academic career (freshman/sophomore) as well as for graduating seniors needs exploration.

The population of students studied had either declared or expressed the intent to declare majors of civil, architectural, and/or environmental engineering. To help explain student behavior, the faculty who taught the student participants were also interviewed to determine if instructor pedagogical practices, including those that use technology, may provide insight into academically dishonest choices.

Research Questions

Using the theory of planned behavior (Ajzen, 1991) as a theoretical framework the following research questions and hypotheses were developed.

- **Research Question 1 (RQ1):** What were the self-reported rates of dishonesty by undergraduate engineering students at various academic levels (freshman/sophomore and senior)?

- **Research Question 2 (RQ2):** What were the differences in perceptions of and descriptions /definitions of academic dishonesty between faculty and engineering students?
- **Research Question 3 (RQ3):** What relationships existed between dishonest choices made by students and the theory of planned behavior?
- **Research Question 4 (RQ4):** To what degree do pedagogical strategies correlate to the rates of dishonesty reported by students?

Hypotheses

There were several null hypotheses based on the research questions.

- **Hypothesis 1 ($H_0$1):** There would be no statistically significant difference between student groups in the reporting of their level of personal ethics and/or their self-reported rates of academic dishonesty.
- **Hypothesis 2 ($H_0$2):** There would be no statistically significant differences between the self-reported rates of academic dishonesty by undergraduate engineering students and the perceived rates of dishonesty by the faculty who taught them.
- **Hypothesis 3 ($H_0$3):** There would be no statistically significant relationship between engineering students' dishonest behaviors and their attitudes, perceptions, and descriptive cultural norms of such behaviors.
- **Hypothesis 4 ($H_0$4):** Pedagogical strategies would not influence the rates of self-reported academic dishonesty by undergraduate engineering students with statistical significance.

Data Description

Data were collected in two distinct ways. Initial quantitative data were collected through online, anonymous student and faculty surveys. Though the surveys were administered online, they were provided to students within their regularly scheduled class time and to faculty in their offices. The researchers were present, administered the surveys, and collected all data. A follow-up interview of faculty participants was used to substantiate and to further explain the quantitative findings. The faculty interviews occurred immediately following completion of the faculty survey for each participant.

Survey Data

Demographic and background information were collected from student and faculty participants. Student participants were asked their gender, age, class level, and major/intended major (see Appendix A – Student Instrument). Faculty participants were asked their gender, number of semesters teaching college students, number of semesters teaching the class being surveyed, and typical instances of academic dishonesty investigated in the same class per semester (see Appendix B – Faculty Instrument). Demographic and background data allowed for a comparison between groups of students as well as individual instructor experiences and pedagogical practices.

In addition to demographic and background data, student participants were asked how ethical they thought they were, and faculty were asked how ethical they thought their students were, using a Likert scale of 1 (*very ethical*) to 5 (*not at all ethical*). These questions were asked at the beginning of the surveys, just after demographic questions, and again with reverse-coding at the end of each survey. In both comparisons, a Wilcoxon Rank Sum test revealed no statistically significant differences ($\alpha=0.05$)

between self-reported ethics of freshman/sophomore (*M*=1.71, *SD*=0.59 *M*=2.61, *SD*=1.31) and senior students (*M*=1.71, *SD*=0.61, *M*=2.42, *SD*=1.24). This supports $H_0$1(there would be no differences between student groups in reporting personal ethics and/or their self-reported rates of academic dishonesty). The data analysis plan for the study incorporated Cronbach's alpha to determine internal consistency reliability using these two questions. However, the data revealed that both student and faculty perceptions of student ethical standards varied from the first-time questions were answered (early in the survey) to the second time they were answered (late in the survey). As a result, Cronbach's alpha was lower than expected (*all students*=0.62, *faculty*=0.38), which was indicative of either poor internal reliability or that the series of questions led to a change of perception (see Appendix D).

A paired Wilcoxon Rank Sum test was used to identify differences in perceptions between groups (see Table 6). The Wilcoxon Rank Sum was chosen instead of a paired *t*-test because the data were not normally distributed, the faculty population was small (*n*=6) and the data were collected using a categorical scale (Cody, 2016). The Wilcoxon Rank Sum test revealed that both student populations (freshman/sophomore and senior) ranked their own ethical standards higher early in the survey and significantly lower toward the end of the survey. Similarly, using a Likert scale of 1 (*very ethical*) to 5 (*not at all ethical*), the faculty participants ranked their students with a higher ethical standard early in the survey (*M*=2.17) and significantly lower when asked toward the end of the survey (*M*=2.50). This finding suggests that once the examples and descriptions/definitions of academic dishonesty were presented during the survey,

students and faculty adjusted their ratings based on the descriptions, which was an unintended, though informative, result.

Table 6

Student reports of personal ethics and faculty reports of perceptions of student ethics

Population	*n*	Cronbach's alpha	*M*1	*M*2	*p* value (α = 0.05)
Freshman/Sophomores	31	0.61	1.71	2.61	<0.0001
Seniors	52	0.63	1.71	2.42	<0.0001
All Students	83	0.62	1.71	2.49	<0.0001
Faculty	6	0.38	2.17	2.50	<0.0001

Note. *M*1 = the first time the ethical question was asked, and *M*2 is the second time. Cronbach's alpha: $0.7 > r \geq 0.6$=poor internal reliability; $r < 0.5$=unacceptable.

Twelve dishonest behaviors, nine of which were defined as dishonest by previous research (Bowers, 1964; McCabe & Trevino, 1993) (see Table 4), were presented to both the faculty and students using a five-point Likert scale. The 12 behaviors were presented three times, each time with a different focus in alignment with the theory of planned behavior (Ajzen, 1991). The first section asked students and faculty to describe how dishonest each of the 12 behaviors was. The second section asked students to report their attempts of each behavior and faculty to report the number of attempts they encountered during the semester. The third section asked both students and faculty to classify the perceived descriptive norm of each of the 12 behaviors. The descriptive norm (i.e., how often does the behavior occur) was asked for both class level as well as for the campus in general to determine if the proximity of the norm (within the class versus across campus) would make a difference in the salience of the responses. Participants were also asked

about ease of committing dishonest behaviors in general in the courses studied (see Appendices A and B).

Descriptive Statistics

Frequency counts were calculated for the genders of all student participants as well as age, major, and the class level (see Table 7). Frequency counts were also calculated for faculty teaching experience, total semesters teaching the class and reported instances of academic dishonesty per semester. The mean, median, mode, and standard deviation were calculated for other survey sections as well as the faculty perceptions of student behavior and rates of dishonesty in their courses (see Tables 13, 15-17 and Figure 3). Using a Likert-type scale, data provided categorical information for each of the 12 dishonest behaviors (see Table 4), which focused on attitude, attempts of dishonesty, and perceived descriptive norms of each behavior.

Table 7

Frequency Counts of Civil, Architectural, and Environmental Engineering Student Demographics

Baseline characteristic	Freshman/Sophomore	Senior
Gender		
Female	17 (54.8%)	18 (34.6%)
Male	14 (45.2%)	34 (65.4%)
Age		
18-19	30	-
20-21	1	2
22-23	-	35
24-25	-	10
26-27	-	1
28+	-	4
Major		
Civil	15	34
Architectural	8	11
Environmental	8	7

Table 7

Frequency Counts of Civil, Architectural, and Environmental Engineering Student Demographics

Baseline characteristic	Freshman/Sophomore		Senior
Student Count	24 (28.9%)	7 (8.4%)	52 (62.7%)

Note. "-" no datapoints were collected for demographic category.

According to institutional data (Registrar, 2019), all freshman engineering students were enrolled in a first-year experience course. Freshman/sophomore students also must declare a major later, and it was unknown at the time of the survey how many students may or may not have been accepted into the department. Additionally, the 52 seniors in the sample represented 16.4% of the 318 seniors enrolled in the department during the fall semester (Registrar, 2019). Of the 318 seniors, 213 (67.0%) were civil engineering majors, 49 (15.4%) were architectural engineering majors, and 56 (17.6%) were environmental engineering majors. There were 212 (66.7%) males and 106 (33.3%) females enrolled in the department during the 2019 fall semester.

Faculty participants (66.7% male, 33.3% female) were all experienced instructors: two (33.3%) reported between nine and 12 semesters of college teaching experience and four (66.7%) reported 17 or more semesters of teaching experience. Additionally, only one of the instructors (16.7%) was new to teaching their current class in the sequence, while two (33.3%) had been teaching their classes for nine to 12 semesters and three (50%) had been teaching their classes for 17 or more semesters.

When surveyed about typical instances of dishonesty they caught in the courses being surveyed, two instructors (33.3%) reported between one and five instances, three (50.0%) reported between six and ten instances, and one (16.7%) reported between 16

and 20 instances per semester. To protect the anonymity of the instructors, no further analytical breakdown was conducted.

Results and Analysis

Survey questions asked students and faculty to report on specific student behaviors, both actionable and perceived. The resulting data provided a foundation for student attitudes, intentions, and behaviors related to academic dishonesty in an introductory engineering design course and a senior design course. The questions gathered information related to: student and faculty descriptions of and attitudes toward academic dishonesty, student attempts of dishonesty and faculty perceptions of the same, ease of academic dishonesty in the classes being surveyed, and faculty and student perceptions about the frequency and normalcy of dishonest behaviors of typical undergraduate engineering students in the class and at the institution as a whole. The following is a summary of the results.

Descriptions of Dishonesty

Each of the 12 behaviors was classified as dishonest on a five-point Likert-scale including 0 (*I don't know*) followed by a dishonesty scale of 1 (*not very dishonest*) to 4 (*very dishonest*) (see Table 4). The responses of 0 (*I don't know*), were removed from the analyzed data. This prevented scores of zero from skewing the data toward the lower numerical end of the scale "*not very dishonest*" because "*I don't know*" is outside of the scale. Therefore, though the data was collected on a five-point scale, the analysis was based on a four-point scale. This question explained student attitudes toward dishonesty, through their descriptions of dishonesty, as compared to faculty descriptions of dishonesty.

To compare the two student groups (see Table 8) a Wilcoxon Rank sum test was conducted. There were significant differences (α=0.05) between the attitudes and descriptions/definitions of 11 of the 12 behaviors. The only behavior that did not show a statistically significant difference, was "including resources not reviewed or used on a bibliography," where students generally reported the behavior as "slightly dishonest" to "dishonest," *M*=2.30 (freshman/sophomores) and *M*=2.52 (seniors). All 11 of the other dishonest behaviors, when compared between freshman/sophomores and seniors, were defined with statistical significance as more dishonest by the seniors compared to the freshman/sophomore students. These results reject $H_0 1$ (there would be no differences between student groups their reported level of personal ethics and/or their self-reported rates of academic dishonesty). However, these data alone are not conclusive evidence of heightened ethics in seniors when compared to freshman/sophomores because from the data, one cannot determine if seniors behaved more ethically or if they simply had a greater knowledge of ethical standards and/or a better attitude toward honesty in the classroom. In other words, the data cannot parse out the difference between student knowledge/attitudes and actual behavior.

Table 8

Student Descriptions of Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Senior (*n*=52)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	2.19	0.78	2.85	0.83	<.001*
Included resources not reviewed or used on a bibliography	2.30	0.71	2.13	1.22	.46

Table 8

Student Descriptions of Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Senior (*n*=52)		
	M	*SD*	*M*	*SD*	*p*
Plagiarizing from public material on papers	1.71	0.90	3.35	1.00	<.001*
Getting questions or answers from someone who has already taken the same exam	2.03	1.00	3.06	0.98	<.001*
Copying from another student on a test or exam	1.32	0.59	3.63	0.71	<.001*
Working on the same homework with several students when the teacher does not allow it	2.23	0.88	2.81	0.84	.01*
Turning in papers done entirely or in part by other students	1.42	0.66	3.54	0.83	<.001*
Giving answers to other students during an exam	1.32	0.64	3.58	0.78	<.001*
Using unauthorized crib notes during an exam	1.45	0.81	3.52	0.75	<.001*
Using unauthorized digital/online resources during a test or exam	1.45	0.72	3.62	0.72	<.001*
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	2.13	1.02	2.62	0.99	.03*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.55	0.89	3.54	0.83	<.001*

Note. 1= "*not dishonest*" to 4= "*very dishonest*";
Pr > |*Z*|; * "statistically significant at" *p*<.05.

When comparing the student descriptions to faculty descriptions using the Wilcoxon Rank Sum, several more findings in opposition of $H_0 1(\alpha = 0.05)$ (there would be no differences between student groups in the reporting of their level of personal ethics and/or their self-reported rates of academic dishonesty) were revealed (see Tables 9-11).

There were statistically significant differences between the freshman/sophomore students and the faculty, but there were no statistically significant differences (α=0.05) between the descriptions of seniors and those of the faculty. These results are encouraging and may be indicative of a positive relationship between student class level and understanding of engineering ethics. In each case, the faculty defined the behavior as more dishonest than the freshman/sophomore students.

These findings do not support $H_0 1$ because there were statistically significant differences (α =0.05) when comparing the freshman/sophomores to the seniors.

Table 9

Faculty vs. Freshman/Sophomore Descriptions of Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	2.19	0.79	2.83	0.75	.08
Included resources not reviewed or used on a bibliography	2.30	0.72	2.50	0.84	.42
Plagiarizing from public material on papers	1.71	0.90	2.80	1.10	.03*
Getting questions or answers from someone who has already taken the same exam	2.03	1.02	3.40	0.89	.02*
Copying from another student on a test or exam	1.32	0.60	3.60	0.89	<.001*
Working on the same homework with several students when the teacher does not allow it	2.23	0.88	2.83	0.75	.14
Turning in papers done entirely or in part by other students	1.42	0.67	3.40	0.89	<.001*
Giving answers to other students during an exam	1.32	0.65	3.60	0.89	<.001*

Table 9

Faculty vs. Freshman/Sophomore Descriptions of Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Using unauthorized crib notes during an exam	1.50	0.78	3.00	0.71	.003*
Using unauthorized digital/online resources during a test or exam	1.45	0.72	3.40	0.89	.002*
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	2.13	1.02	3.33	0.82	.02*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.55	0.89	4.00	0.00	<.001*

Note. 1= "*not dishonest"* to 4= "*very dishonest*".
Pr > |*Z*|; *statistically significant at *p*<.05.

The Wilcoxon Rank Sum comparison between senior students and faculty was less remarkable. No statistically significant differences were noted between seniors and faculty in their descriptions of academic dishonesty as related to the 12 behaviors in the survey (see Table 10). This is indicative that seniors who are approaching graduation have developed descriptions and definitions of dishonesty in alignment with those of the faculty.

Table 10

Faculty vs. Seniors Description of Academically Dishonest Behavior

Descriptions of academic dishonesty	Seniors (*n*=52)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	2.85	0.83	2.83	0.75	.94
Included resources not reviewed or used on a bibliography	2.52	0.88	2.50	0.84	.96
Plagiarizing from public material on papers	3.41	0.90	2.80	1.10	.19
Getting questions or answers from someone who has already taken the same exam	3.06	0.98	3.40	0.89	.46
Copying from another student on a test or exam	3.63	0.71	3.60	0.89	.88
Working on the same homework with several students when the teacher does not allow it	2.81	0.84	2.83	0.75	1.00
Turning in papers done entirely or in part by other students	3.54	0.83	3.40	0.89	.66
Giving answers to other students during an exam	3.58	0.78	3.60	0.89	.77
Using unauthorized crib notes during an exam	3.52	0.75	3.00	0.71	.07
Using unauthorized digital/online resources during a test or exam	3.62	0.72	3.40	0.89	.54
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	2.67	0.93	3.33	0.82	.11
Purchasing homework, essays, papers, etc. from online sources to submit as their own	3.54	0.83	4.00	0.00	.21

Note. 1= "*not dishonest"* to 4= "*very dishonest*";
Pr > |*Z*|; *statistically significant at $p<.05$.

Of the nine findings that related student and faculty descriptions (see Tables 9-11 and Figure 1), two were statistically significant in the freshman/sophomore population (see Table 9) to reveal a finding when comparing the entire student group (freshman/sophomores plus seniors) to the faculty (see Table 11 and Figure 1); that is using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects; and purchasing homework, essays, papers, etc. from online sources to submit as their own. These findings indicate an overall discourse between students in general and faculty.

Table 11

Faculty vs. All Students Description of Academically Dishonest Behavior

Descriptions of academic dishonesty	All Students (*n*=83)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	2.60	0.87	2.83	0.75	.52
Included resources not reviewed or used on a bibliography	2.43	0.82	2.50	0.84	.72
Plagiarizing from public material on papers	2.77	1.22	2.80	1.10	.95
Getting questions or answers from someone who has already taken the same exam	2.67	1.11	3.40	0.89	.15
Copying from another student on a test or exam	2.77	1.31	3.60	0.89	.14
Working on the same homework with several students when the teacher does not allow it	2.59	0.90	2.83	0.75	.55
Turning in papers done entirely or in part by other students	2.75	1.29	3.40	0.89	.29
Giving answers to other students during an exam	2.73	1.32	3.60	0.89	.13

Table 11

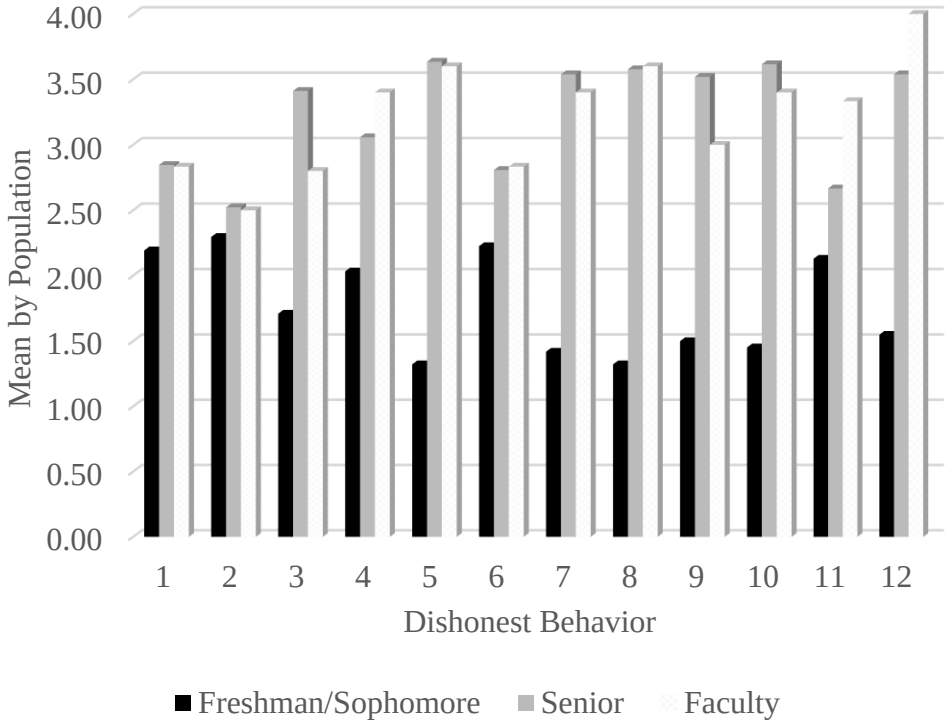
Faculty vs. All Students Description of Academically Dishonest Behavior

Descriptions of academic dishonesty	All Students (*n*=83)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Using unauthorized crib notes during an exam	2.78	1.24	3.00	0.71	.94
Using unauthorized digital/online resources during a test or exam	2.81	1.27	3.40	0.89	.34
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	2.46	1.00	3.33	0.82	.046*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	2.79	1.29	4.00	0.00	.0497*

Note. 1= "*not dishonest"* to 4= "*very dishonest*";
Pr > |*Z*|; *statistically significant at *p*<.05.

Figure 1

Faculty vs. Student Descriptions of Academically Dishonest Behavior



Note. 1= "*not dishonest"* to 4= "*very dishonest*".

1. Copying a few sentences of material without proper citation in a paper
2. Included resources, not reviewed or used, on a bibliography
3. Plagiarizing from public material on papers
4. Getting questions or answers from someone who has already taken the exam
5. Copying from another student on a test or exam
6. Working on the same homework with several students when the teacher does not allow it
7. Turning in papers done entirely or in part by other students
8. Giving answers to other students during an exam
9. Using unauthorized crib notes during an exam
10. Using unauthorized digital/online resources during a test or exam
11. Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects
12. Purchasing homework, essays, papers, etc. from online sources to submit as their own

Ease of Dishonesty

Students were asked to report the ease of dishonesty in the class for which they took the survey (see Table 12). Faculty were asked to report their perceptions of the

same. This question was then compared to the pedagogical practices revealed during the qualitative faculty interviews in Phase 2 to determine pedagogical strategies and assessment types that might deter cheating. The freshman/sophomore students reported that it was easier to cheat (M=3.48) in their class than the seniors reported (M =2.63) (see Table 12).

The descriptive data for the ease of dishonesty question further helps to explain the finding that freshman/sophomore students reported ease of cheating that was statistically significantly different from both the seniors and the faculty (see Table 12). The question asked respondents to rate the ease of dishonesty on homework and other assessments for the class from 1(“*not at all easy”)* to 5 (“*very easy”)*.

The higher group means in the freshman/sophomore responses are indicative of a poor attitude toward honesty and a perceived descriptive norm of cheating behaviors (see Table 12), which rejects $H_0$3 (there would be no relationship between engineering students’ dishonest behaviors and their attitudes, perceptions, and descriptive cultural norms of such behaviors). Additionally, faculty perceived their classes as being more difficult to be dishonest than what students reported (i.e., a lower group mean), which is indicative of the need for further evaluation of pedagogical strategies that might prevent academic dishonesty.

Information from the qualitative faculty interviews was also helpful in the analysis related to ease of dishonesty. The freshman/sophomore class included a project and a software component. The instructor explained that most of the cheating caught in the class was in the submission of the software component, where students were asked to choose from five software programs to complete online modules. Throughout the

semester, students chose a different program and some students would then share their work from the previous module. There were no grounded or authentic assessments used when students worked on the software modules. The instructor explained that they were able to catch the students who cheated because of subtle differences in the project files.

Table 12

Faculty vs. Student Perceptions of Ease of Academic Dishonesty

Population 1	*n*	*M*	*SD*	Population 2	*p*
Freshman/Sophomore	31	3.48	1.18	Senior	.006*
Senior	52	2.63	1.03	Faculty	.67
All Students	83	2.96	1.31	Faculty	.26
Faculty	6	2.33	1.03	Freshman/Sophomore	.046*

Note. 1= "*not dishonest"* to 4= "*very dishonest*".
Pr > |*Z*|; *statistically significant at *p*<.05.

The faculty interviews confirmed that in the design projects, it was very difficult for two groups to produce or recreate identical content. The descriptions provided by faculty included assignment prompts that changed each semester and were different for each group within the class, which is an example of grounded assessment. The seniors were also tasked with creating a design project based on a real structure, where they worked with contractors and/or consultants who worked on the actual project during its design, an example of authentic assessment. Furthermore, the students were actively engaged in the design, development, and in the case of the freshman/sophomores, execution of the project, which included robust active learning activities. The use of these three pedagogical strategies; grounded assessment, authentic assessment and active learning in the two design classes was associated with reduced reports of dishonesty, and thus rejected $H_0$4 (Pedagogical strategies would not significantly influence the rates of

self-reported academic dishonesty by undergraduate engineering students). There was a statistically significant difference between pedagogical strategies (α=0.05) (see Table 12). Though both classes used grounded assessment and active learning, the senior class incorporated it in an authentic, real-world experience. Additionally, because the freshman/sophomore class had an online component that was lacking in those pedagogical strategies, the revelation that the freshman/sophomores reported more cheating was further evidence to reject $H_0$4 (pedagogical strategies would not influence the rates of self-reported academic dishonesty by undergraduate engineering students).

It is important to note that only one faculty in the participant pool taught each student group with regard to the comparison between the student groups and faculty. As a result, the comparisons between both student groups (freshman/sophomore or senior) and the faculty might be misleading. These data were analyzed to determine general discrepancies in perceptions between faculty and students, but not to determine a discrepancy within one specific class, as such a comparison would jeopardize the anonymity of the faculty participants. This was considered a limitation of the study and further research is needed for this issue.

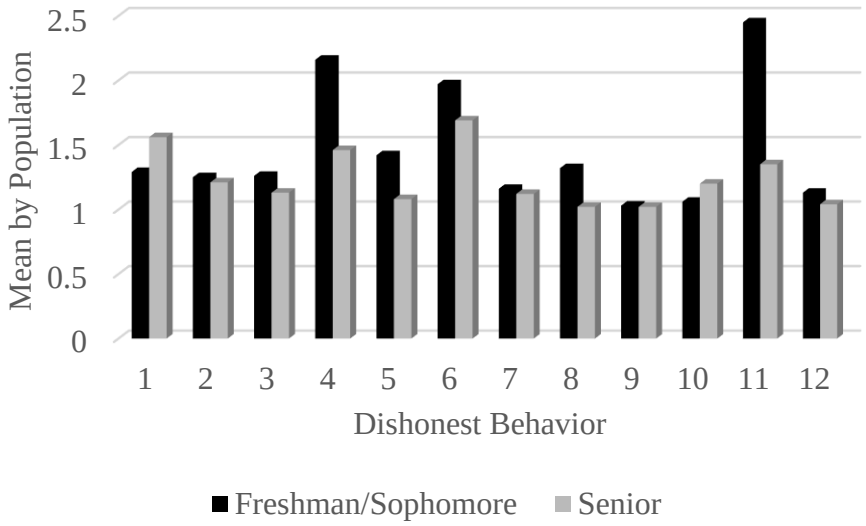
Attempts of Academic Dishonesty

Students were asked to report on their actual attempts of the 12 academically dishonest behaviors. When comparing the results of the student surveys between freshman/sophomores and seniors, five statistically significant differences were identified: copying without citation; getting answers from someone who has already taken the exam; copying from another student on a test or exam; giving answers to

another student during an exam; and using unauthorized digital or online resources on homework, assignments, papers, and projects (see Figure 2 and Table 13).

Figure 2

Student Attempts of Academically Dishonest Behavior



Note. 1= "*zero attempts*" to 5= "*4 or more attempts*".

1. Copying a few sentences of material without proper citation in a paper
2. Included resources, not reviewed or used, on a bibliography
3. Plagiarizing from public material on papers
4. Getting questions or answers from someone who has already taken the exam
5. Copying from another student on a test or exam
6. Working on the same homework with several students when the teacher does not allow it
7. Turning in papers done entirely or in part by other students
8. Giving answers to other students during an exam
9. Using unauthorized crib notes during an exam
10. Using unauthorized digital/online resources during a test or exam
11. Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects
12. Purchasing homework, essays, papers, etc. from online sources to submit as their own

Four of the five items (getting answers from someone who has already taken the exam, copying from another student on a test or exam, giving answers to another student during an exam, using unauthorized digital or online resources on homework,

assignments, papers, and projects) suggest that freshman/sophomores attempted these behavior more frequently than seniors (see Table 13). Coupling these data with the stricter descriptions of dishonesty by senior students provided additional evidence to reject $H_0$1(there would be no differences between student groups in reporting their level of personal ethics and/or their self-reported rates of academic dishonesty).

Prior research is consistent with the plagiarism finding. Khalid (2015) found that undergraduate upper-level students cheat more via plagiarism due to the changing nature of the assessment and pedagogical practices used as a student approaches graduation. Also, Henslee et al. (2015) did not see improvement in behaviors related to plagiarism when studying the effect of an online training module for freshman. Considering these findings, it can be concluded that freshman may be less likely to plagiarize, and thus "copying a few sentences of material without proper citation in a paper" is a behavior that would be seen more often from seniors. Because the other dishonest behaviors of significance were all reported more frequently by freshman/sophomores, $H_0$1 (there would be no differences between student groups in the reporting of their level of personal ethics and/or their self-reported rates of academic dishonesty) was again rejected.

Table 13

Student Attempts of Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Senior (*n*=52)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	1.29	0.99	1.56	1.38	.009*
Included resources not reviewed or used on a bibliography	1.25	0.82	1.21	0.46	.55

Table 13

Student Attempts of Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Senior (*n*=52)		
	M	*SD*	*M*	*SD*	*p*
Plagiarizing from public material on papers	1.26	0.82	1.13	0.40	.80
Getting questions or answers from someone who has already taken the same exam	2.16	1.24	1.46	0.94	.003*
Copying from another student on a test or exam	1.42	0.89	1.08	0.27	.049*
Working on the same homework with several students when the teacher does not allow it	1.97	1.44	1.69	1.33	.40
Turning in papers done entirely or in part by other students	1.16	0.73	1.12	0.44	.82
Giving answers to other students during an exam	1.32	0.83	1.02	0.14	.008*
Using unauthorized crib notes during an exam	1.03	0.18	1.02	0.14	.73
Using unauthorized digital/online resources during a test or exam	1.06	0.25	1.20	1.00	.57
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	2.45	1.82	1.35	1.12	.002*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.13	0.72	1.04	0.20	.91

Note. 1= "*zero attempts*" to 5= "*4 or more attempts*".
Pr > |*Z*|; * "statistically significant at" $p<.05$.

Perceptions of Academic Dishonesty in This Class

A Wilcoxon Rank Sum test was conducted to compare the rates of academic dishonesty reported by students to the perceived rates by faculty when asked about their

specific course. There were no statistically significant differences between the freshman/sophomore student reports and the faculty perceived rates (see Table 14).

Table 14

Faculty Perceptions vs. Freshman/Sophomore Attempts of Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	1.29	0.82	1.67	1.2	0.30
Included resources not reviewed or used on a bibliography	1.26	0.83	1.50	1.22	0.78
Plagiarizing from public material on papers	1.26	0.83	1.50	1.22	0.78
Getting questions or answers from someone who has already taken the same exam	2.16	1.24	1.33	0.52	0.13
Copying from another student on a test or exam	1.42	0.87	1.5	0.55	0.32
Working on the same homework with several students when the teacher does not allow it	1.97	1.45	1.67	1.63	0.44
Turning in papers done entirely or in part by other students	1.16	0.73	1.16	0.89	0.46
Giving answers to other students during an exam	1.32	1.02	1.17	0.41	0.88
Using unauthorized crib notes during an exam	1.03	0.18	1.17	0.41	0.21
Using unauthorized digital/online resources during a test or exam	1.06	0.25	1.33	0.52	0.07
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	2.45	1.71	1.67	0.41	0.09

Table 14

Faculty Perceptions vs. Freshman/Sophomore Attempts of Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.13	0.72	1.00	0.00	0.72

Note. 1= "*zero attempts*" to 5= "*4 or more attempts*".
Pr > |*Z*|; * "statistically significant at" $p<.05$.

In the Wilcoxon Rank Sum comparison between the seniors and the faculty, there was one statistically significant finding related to rates of academic dishonesty; copying from another student on a test or exam (see Table 15). The seniors reported that they copied from another student less frequently than the faculty reported catching students who copied; 50.0% of faculty reporting one attempt while 91.6% of students reported zero attempts.

Table 15

Faculty Perceptions vs. Seniors Attempts of Academically Dishonest Behavior

Descriptions of academic dishonesty	Seniors (*n*=52)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	1.56	0.64	1.67	1.21	0.73
Included resources not reviewed or used on a bibliography	1.21	0.46	1.50	1.22	0.99
Plagiarizing from public material on papers	1.13	0.40	1.50	1.22	0.64

Table 15

Faculty Perceptions vs. Seniors Attempts of Academically Dishonest Behavior

Descriptions of academic dishonesty	Seniors (*n*=52)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Getting questions or answers from someone who has already taken the same exam	1.46	0.94	1.33	0.52	0.91
Copying from another student on a test or exam	1.08	0.27	1.50	0.55	0.01*
Working on the same homework with several students when the teacher does not allow it	1.69	1.26	1.67	1.63	0.61
Turning in papers done entirely or in part by other students	1.12	0.44	1.17	0.89	0.54
Giving answers to other students during an exam	1.02	0.14	1.17	0.41	0.08
Using unauthorized crib notes during an exam	1.02	0.14	1.17	0.41	0.08
Using unauthorized digital/online resources during a test or exam	1.20	0.69	1.33	0.52	0.14
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	1.35	0.82	1.17	0.41	0.74
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.04	0.20	1.00	0.00	0.66

Note. 1= "*zero attempts*" to 5= "*4 or more attempts*".
Pr > |*Z*|; * "statistically significant at" $p<.05$.

The difference between the senior and faculty perceptions of copying from another student on a test or exam was such that when faculty were compared to all students, it remained significance (see Table 16 and Figure 3). However, because the student population includes only those in one freshman/sophomore class and one senior class, while the faculty data included instructors who taught within the whole sequence, these

data could be misleading. Furthermore, to protect faculty anonymity, a comparison between the students and the faculty who taught them was not included in the results. As previously noted, this was a limitation of the study. Therefore, though statistically significant, this one datapoint is insufficient to determine whether the reported rates of specific groups of students and the faculty who teach them differs, therefore further study is needed. Because there was no other significant difference between the student reports and faculty perceptions, $H_0 2$ (there would be no statistically significant differences between the self-reported rates of academic dishonesty by undergraduate engineering students and the perceived rates of dishonesty by the faculty who taught them) was accepted.

Table 16

Faculty Perceptions vs. All Student Attempts of Academically Dishonest Behavior

Descriptions of academic dishonesty	All Students (*n*=83)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	1.46	0.72	1.67	1.21	.95
Included resources not reviewed or used on a bibliography	1.23	0.61	1.50	1.22	.90
Plagiarizing from public material on papers	1.18	0.59	1.50	1.22	.67
Getting questions or answers from someone who has already taken the same exam	1.72	1.11	1.33	0.52	.56
Copying from another student on a test or exam	1.21	0.60	1.50	0.55	.03*
Working on the same homework with several students when the teacher does not allow it	1.79	1.33	1.67	1.63	.52

Table 16

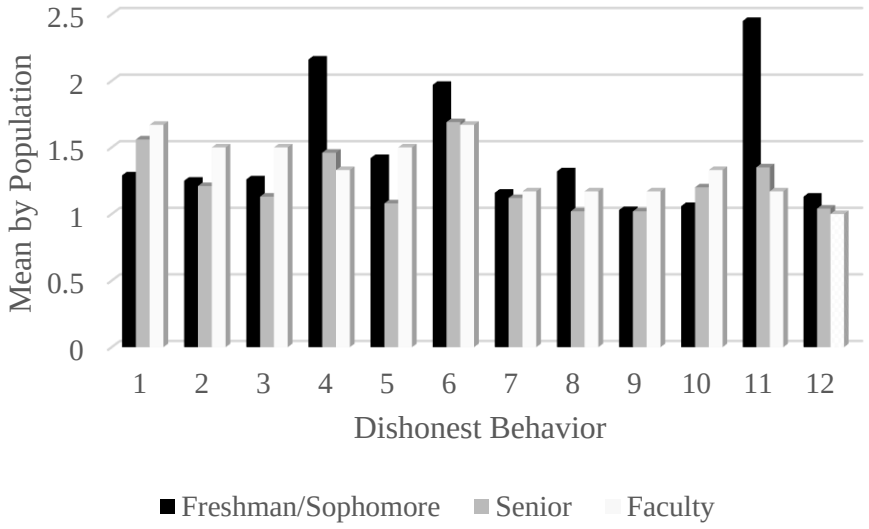
Faculty Perceptions vs. All Student Attempts of Academically Dishonest Behavior

Descriptions of academic dishonesty	All Students (*n*=83)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Turning in papers done entirely or in part by other students	1.14	0.56	1.17	0.41	.47
Giving answers to other students during an exam	1.13	0.53	1.17	0.41	.54
Using unauthorized crib notes during an exam	1.02	0.16	1.17	0.41	.07
Using unauthorized digital/online resources during a test or exam	1.15	0.57	1.33	0.52	.07
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	1.77	1.34	1.17	0.41	.34
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.07	0.47	1.00	0.00	.66

Note. 1= "*zero attempts*" to 5= "*4 or more attempts*".
Pr > |*Z*|; * "statistically significant at" $p<.05$.

Figure 3

Faculty Perceptions vs. Student Attempts of Academically Dishonest Behavior



Note. 1= "*zero attempts*" to 5= "*4 or more attempts*".

1. Copying a few sentences of material without proper citation in a paper
2. Included resources, not reviewed or used, on a bibliography
3. Plagiarizing from public material on papers
4. Getting questions or answers from someone who has already taken the exam
5. Copying from another student on a test or exam
6. Working on the same homework with several students when the teacher does not allow it
7. Turning in papers done entirely or in part by other students
8. Giving answers to other students during an exam
9. Using unauthorized crib notes during an exam
10. Using unauthorized digital/online resources during a test or exam
11. Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects
12. Purchasing homework, essays, papers, etc. from online sources to submit as their own

Perceptions of Typical Academic Dishonesty

In addition to asking about academic dishonesty within the classes being surveyed, students and faculty were asked to report what they perceived as typical rates of academic dishonesty. There were two significant results in student perceptions of typical academic dishonesty (see Table 17). In both findings, the freshman/sophomore students perceived higher rates of dishonesty than the seniors. The freshman/sophomore

(*M*=3.42) and senior students (*M*=2.69) disagreed about how often the typical student obtained answers from someone who had already taken the exam. Fifty-two percent of freshman/sophomores (*n*=16) perceived that students obtained answers to exams compared to 21.2% of seniors (*n*=11). They also disagreed about how often students typically used unauthorized digital/online resources to obtain answers to homework, assignments, papers and projects (freshman/sophomore: *M*=3.48, *SD*=1.34; seniors: *M*=2.71, *SD*=1.27). Fifty-five percent of freshman/sophomores (*n*=17) perceived that students used unauthorized digital/online resources to obtain answers to homework more than four times per semester or even weekly compared to 28.8% of seniors (*n*=15). These were two of the same behaviors that significantly differed in the self-reports of student academic dishonesty (see Table 13).

In a comparison using the Wilcoxon Rank Sum test freshman/sophomore students reported higher rates (*M*=2.16) than seniors (*M*=1.46) when asked about getting answers from someone who has already taken the exam (see Table 13). When asked about perceptions of the same behavior, the freshman/sophomore students also perceived that sharing exam answers with the next class was more common (*M*=2.00) than what was perceived by seniors (*M*=1.73), which favors a perceived descriptive norm, as indicated by the theory of planned behavior (Ajzen, 1991) and rejects $H_0$3 (there would be no relationship between engineering students' dishonest behaviors and their attitudes, perceptions, and descriptive cultural norms of such behaviors).

The same trend was revealed in the perceived rates of using unauthorized digital/online resources on homework, assignments, papers and projects. The freshman/sophomore students reported higher perceived rates (*M*=3.48) than their own

self-reported behavior (*M*=2.45). Again, this finding supports a perceived descriptive behavioral norm within the population of freshman/sophomore students and rejects $H_0$3 for that population.

The two significant findings of perceived descriptive behavioral norm within the freshman/sophomore population indicated that students of a lower grade level tended to be more accepting of fewer personal ethics than those of an upperclassman. This finding contradicts the freshman/sophomore self-reported data of how ethical they were personally, which were not statistically different from the seniors. When coupled with the self-reported rates of academically dishonest behaviors (see Table 13), $H_0$1 (there would be no differences between student groups in the reporting of their level of personal ethics and/or their self-reported rates of academic dishonesty) was rejected.

Table 17

Student Perceptions of Typical Student's Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Senior (*n*=52)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	2.19	0.75	2.35	0.81	.54
Included resources not reviewed or used on a bibliography	1.87	0.81	1.90	0.69	.71
Plagiarizing from public material on papers	1.94	0.829	1.78	.67	.60
Getting questions or answers from someone who has already taken the same exam	3.42	1.08	2.69	1.11	.01*
Copying from another student on a test or exam	2.32	1.17	1.92	1.00	.10

Table 17

Student Perceptions of Typical Student's Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Senior (*n*=52)		
	M	*SD*	*M*	*SD*	*p*
Working on the same homework with several students when the teacher does not allow it	3.51	1.31	3.69	1.13	.62
Turning in papers done entirely or in part by other students	1.77	0.80	1.54	0.70	.16
Giving answers to other students during an exam	2.00	1.08	1.73	0.87	.35
Using unauthorized crib notes during an exam	1.87	1.07	1.75	0.82	.96
Using unauthorized digital/online resources during a test or exam	1.94	1.03	1.60	0.66	.22
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	3.48	1.34	2.71	1.27	.01*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.77	0.85	1.62	0.89	.27

Note. 1= "*not at all", 2="1 or 2 times per semester", 3="3 or 4 times per semester",* 4= "*more than 4 times per semester", 5=*"weekly".
Pr > |*Z*|; * "statistically significant at" $p<.05$.

In the comparison between student and faculty perceptions of the typical student, seven statistically significant differences were revealed (see Tables 18-20 and Figure 4). For each of the seven, both freshman/sophomore and senior students differed from faculty perceptions and the student respondents as a whole differed as well. The seven behaviors that had differing perceptions were: including resources not reviewed or used on a bibliography; plagiarizing from public material on papers; getting questions or answers from someone who has already taken the exam; working on the same homework

with several students when the teacher does not allow it; turning in papers done entirely or in part by other students; using unauthorized digital/online resources during a test or exam; and using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects.

Table 18

Faculty Perceptions vs. Freshman/Sophomore Perceptions of Typical Student's Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	2.19	0.75	1.67	0.82	.14
Included resources not reviewed or used on a bibliography	1.87	0.81	1.17	0.41	.04*
Plagiarizing from public material on papers	1.94	0.89	1.17	.41	.04*
Getting questions or answers from someone who has already taken the same exam	2.00	1.08	1.50	0.55	.40
Copying from another student on a test or exam	2.32	1.17	1.67	0.52	.21
Working on the same homework with several students when the teacher does not allow it	3.51	1.31	1.50	0.55	.003*
Turning in papers done entirely or in part by other students	1.77	0.80	1.00	0.00	.01*
Giving answers to other students during an exam	2.00	1.08	1.50	0.55	.40
Using unauthorized crib notes during an exam	1.87	1.07	1.33	0.52	.32
Using unauthorized digital/online resources during a test or exam	1.94	1.03	1.00	0.00	.03*

Table 18

Faculty Perceptions vs. Freshman/Sophomore Perceptions of Typical Student's Academically Dishonest Behavior

Descriptions of academic dishonesty	Freshman/Sophomore (*n*=31)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	3.48	1.34	1.67	1.21	.01*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.77	1.46	1.17	0.41	.09

Note. 1= "*not at all", 2="1 or 2 times per semester", 3="3 or 4 times per semester",* 4= "*more than 4 times per semester", 5=*"weekly".
Pr > |*Z*|; * "statistically significant at" $p<.05$.

For each of the seven differences, the Wilcoxon Rank Sum test was used for comparison between groups. Students reported a significantly higher perceived rate ($\alpha=0.05$) of academic dishonesty than the faculty perceptions of dishonesty (see Tables 19-20 and Figure 4).

Table 19

Faculty Perceptions vs. Senior Perception of Typical Student's Academically Dishonest Behavior

Descriptions of academic dishonesty	Seniors (*n*=52)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	2.35	0.81	1.67	0.82	0.06*
Included resources not reviewed or used on a bibliography	1.90	0.69	1.17	0.41	.02*
Plagiarizing from public material on papers	1.78	0.67	1.17	.41	.03*

Table 19

Faculty Perceptions vs. Senior Perception of Typical Student's Academically Dishonest Behavior

Descriptions of academic dishonesty	Seniors (*n*=52)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Getting questions or answers from someone who has already taken the same exam	2.69	1.11	1.50	0.55	.01*
Copying from another student on a test or exam	1.90	1.00	1.67	0.52	.80
Working on the same homework with several students when the teacher does not allow it	3.69	1.13	1.50	0.55	.001*
Turning in papers done entirely or in part by other students	1.54	0.70	1.00	0.00	.048*
Giving answers to other students during an exam	1.73	0.87	1.50	0.55	.66
Using unauthorized crib notes during an exam	1.75	0.72	1.33	0.52	.24
Using unauthorized digital/online resources during a test or exam	1.60	0.66	1.00	0.00	.02*
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	2.71	1.27	1.67	1.21	.045*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.62	0.89	1.17	0.41	.24

Note. 1= "*not at all", 2="1 or 2 times per semester", 3="3 or 4 times per semester",* 4= "*more than 4 times per semester", 5=*"weekly".
Pr > |*Z*|; * "statistically significant at" $p<.05$.

The higher perceived rates of dishonesty by students again supports a difference in perceived descriptive norms of dishonest behaviors in the environment between students and faculty which rejects $H_0$3 (there would be no relationship between

engineering students' dishonest behaviors and their attitudes, perceptions, and descriptive cultural norms of such behaviors). Additionally, the finding that students believe that working on the same homework with several students when the teacher does not allow is consistent with previous research by McCabe, et al. (2012).

Table 20

Faculty Perception vs. All Student's Perception of Typical Student's Academically Dishonest Behavior

Descriptions of academic dishonesty	All Students (*n*=83)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Copying a few sentences of material without proper citation in a paper	2.29	0.79	1.67	0.82	.07
Included resources not reviewed or used on a bibliography	1.89	0.73	1.17	0.41	.02*
Plagiarizing from public material on papers	1.84	0.76	1.17	.41	.03*
Getting questions or answers from someone who has already taken the same exam	2.96	1.15	1.33	0.52	.002*
Copying from another student on a test or exam	2.06	1.07	1.57	0.52	.50
Working on the same homework with several students when the teacher does not allow it	3.63	1.20	1.50	0.55	.001*
Turning in papers done entirely or in part by other students	1.63	0.74	1.00	0.00	.02*
Giving answers to other students during an exam	1.83	0.95	1.00	0.00	.53
Using unauthorized crib notes during an exam	1.79	1.59	1.33	0.52	.25
Using unauthorized digital/online resources during a test or exam	1.72	0.83	1.00	0.00	.02*

Table 20

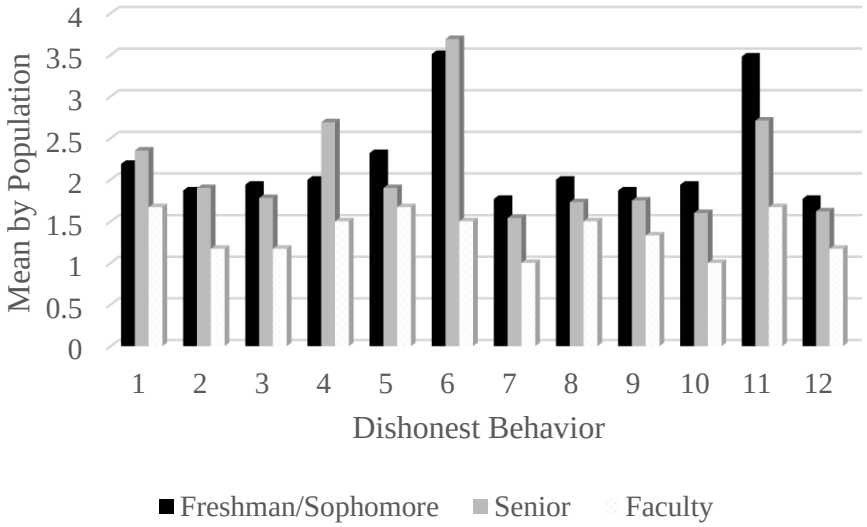
Faculty Perception vs. All Student's Perception of Typical Student's Academically Dishonest Behavior

Descriptions of academic dishonesty	All Students (*n*=83)		Faculty (*n*=6)		
	M	*SD*	*M*	*SD*	*p*
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	3.00	1.34	1.57	1.21	0.02*
Purchasing homework, essays, papers, etc. from online sources to submit as their own	1.67	0.87	1.17	0.41	0.15

Note. 1= "*not at all", 2="1 or 2 times per semester", 3="3 or 4 times per semester",* 4= "*more than 4 times per semester", 5*="weekly".
Pr > |*Z*|; * "statistically significant at" *p*<.05.

Figure 4

Faculty Perception vs. Student's Perception of Typical Student's Academically Dishonest Behavior



Note. 1= "*not at all", 2="1 or 2 times per semester", 3="3 or 4 times per semester",* 4= "*more than 4 times per semester", 5*="weekly".
1. Copying a few sentences of material without proper citation in a paper
2. Included resources, not reviewed or used, on a bibliography

3. Plagiarizing from public material on papers
4. Getting questions or answers from someone who has already taken the exam
5. Copying from another student on a test or exam
6. Working on the same homework with several students when the teacher does not allow it
7. Turning in papers done entirely or in part by other students
8. Giving answers to other students during an exam
9. Using unauthorized crib notes during an exam
10. Using unauthorized digital/online resources during a test or exam
11. Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects
12. Purchasing homework, essays, papers, etc. from online sources to submit as their own

Attempts at Dishonesty Versus Perceptions

A comparison between the student rates of academic dishonesty and the perceived rates of dishonesty of typical students provided valuable information. A Wilcoxon Signed Rank paired *t*-test was conducted for each of the 12 dishonest behaviors to compare actual student attempts to student perceptions of attempts by a typical student. The Wilcoxon Signed Rank is the paired equivalent to the Wilcoxon Rank Sum used for non-parametric analyses. The data were not normally distributed; thus this test was sufficient for analysis (Cody, 2016).

For each of the 12 dishonest behaviors, there was a statistically significant difference ($p<0.0001$) in student reports. Students reported higher perceived rates of the behavior than their descriptions of each behavior (see Figure 1). These data reject $H_0 3$ (there would be no statistically significant relationship between engineering students' dishonest behaviors and their attitudes, perceptions, and descriptive cultural norms of such behaviors) because student perceptions of the rates of academic dishonesty were higher than the actual self-reported rates of academic dishonesty. This finding also favors

a perceived descriptive norm of dishonest behavior as supported by the theory of planned behavior (Ajzen, 1991).

Pedagogical Strategies

Phase 1 collected quantitative data from students (Part A) and faculty (Part B) through an anonymous online survey. Phase 2 collected qualitative data to help explain the results of the quantitative surveys. Six faculty were interviewed during Phase 2. The faculty participants were asked about pedagogical strategies used in their classes, which were then compared against the rates of dishonesty in each class.

As previously discussed, both the freshman/sophomore and senior classes include a large project that was grounded to that group of students in that particular class, and each class included frequent active learning. Additionally, the senior class incorporated an authentic learning project. Though active learning was described in the courses which connected the introductory and senior classes, those classes were described as math problems-based, without project components. Because students were not surveyed in the connecting classes, significant differences between problems-based classes and project-based classes are not differentiated within the data, which is indicative of the need for further research within the sequence of classes. However, the two project-based classes in which students were surveyed, when compared with the faculty interview responses, revealed that when active learning, grounded assessment, and authentic assessment were used, students reported less academic dishonesty, which does not support $H_0 4$ (pedagogical strategies would not influence the rates of self-reported academic dishonesty by undergraduate engineering). Specifically, the project-based activities

typically had lower rates of dishonesty than the online software modules that did not include authentic or grounded assessment strategies.

Additional Qualitative Findings

The faculty interviews revealed additional important information. Themes related to class size, time investment, and campus culture helped to explain constraints and limitations related to the implementation of active learning, grounded assessment, and authentic assessment in the sequence of engineering classes studied. Additionally, the relationship between public safety and ethics, as perceived by the faculty, was revealed. Several other unexpected themes emerged as well. Each qualitative theme can be found in the descriptions that follow.

Active Learning

Faculty described the use of active learning positively, with polling (often facilitated by technology), small group work, student-led board work, and projects being the most often described methods of active learning. With the exception of one instructor who described a mostly lecture-based class, interviewees described frequent use of active learning strategies during each class period. The definitions of terms for the study were provided to each instructor. However, the one instructor who stated that active learning was not used during class did describe frequent question and answer during lecture, office hours after class to engage students and university-sponsored after-class tutoring sessions, each of which was classified as active learning according to the definitions of the study.

When asked to define active learning, every instructor described it from the perspective of the student by citing student behaviors observed while engaged in active

learning. Each instructor also described methods by which they encouraged active learning and engagement with the instructor, the content, and/or other students in the class. Additionally, active learning and student engagement were often described using the same words and examples, which led to the conclusion that faculty participants who use active learning strategies, by definition, have more engaged students.

Faculty comments that were associated with active learning were most often related to the use of lecture in class. Every instructor interviewed includes a lecture component in their class. One instructor had converted the lecture component to use a flipped format where the students viewed the lecture online before coming to class. Another instructor had one online section where students also viewed short lecture videos online to help prepare them for the homework problems. A common sentiment was that developing active learning takes a lot of time and effort in engaging students, and especially in larger classes it is difficult because of limited space. Additionally, instructors described having a large amount of content within the curriculum and a limited amount of class time as a hindrance to incorporate active learning because active learning requires not only more time to design, but also more class time than standard lecture.

Authentic Assessment

Students in the introductory class were exposed to authentic assessment through a design project. The introductory class required students to create a working prototype of a design project that used skills, processes, and software that students will utilize as practicing engineers. Because the class included students from all engineering majors, the project was not focused on one engineering discipline. Rather, the project prompt was

designed as an engaging and fun project that used engineering design skills to build functioning products such as a pinball machine or a beanbag launcher. The project prompt was different each semester and each group had a unique design, which were both indicative of a grounded assessment. The design project allowed students not only to practice the engineering components of the curriculum, but also project updates and professional presentations throughout the semester to gain feedback and drive further development of the project.

Graduating seniors in the senior design class also experienced a design project. This assessment was also grounded in that each semester is a different project and each student group developed the prompt differently, based on their specific skills. Because this class included civil, environmental, and architectural engineers, students refined their collaborative skills by designing a project that incorporated the fundamentals of each of those disciplines.

The project selected each semester used data and information from an actual design project that was under development or had been completed. Through an alumni network, the instructors had developed relationships to allow students to collaborate with the actual project stakeholders during the student design project. Though the students did not work on the actual design, they worked with the actual data and plans from the project. Additionally, students had the opportunity to present to the class as well as a designer or contractor from the alumni network who was involved in the development of the actual project. Students had opportunities to ask questions and present memos to these individuals as well, which closely mimics the actual professional situations they will experience as practicing engineers.

The instructors who taught the classes between the introductory design class and senior design did not describe this level of authentic assessment within their classes. Each of the "middle" instructors described their class as a math-focused, problems-based course with little variability in content, though they all described the creation of new problems each semester that mimic real engineering calculations. Three of the four middle-level instructors described their problems as similar to actual engineering calculations in real engineering situations. The fourth instructor, however, described problems that are designed to be more engaging than realistic. The problems designed by this instructor used situations related to holidays, current events, and even fictitious mob connections to make the content that the instructor taught more fun for students.

Caring for Students

One unanticipated theme that emerged in the qualitative interview was the sense of caring that faculty felt for their students. Three of the six faculty expressed very positive sentiments about their students, but within the entire faculty group, there were no comments that could be associated with faculty not caring about the success of their students. Faculty described a desire to know about their students personally and for students to talk with them about bigger things than just the content. One instructor also described the importance of learning the names of as many students as possible. This instructor also indicated that though they cannot possibly learn the names of all students in very large classes, learning the names of all of those students who would value a personal connection is especially important. This is indicative that even in a large class, it is possible for instructors to build rapport with their students.

Interestingly, these instructors who exhibited this warm sense of caring were also the “middle” instructors who taught the classes that were between the introductory and final design classes. These were the instructors of classes that were very tedious and heavily problems-based, the classes where students may find it difficult to emotionally connect to the content itself like they would on a project where they invest their own creativity and innovation. The instructors who described the greatest sense of caring were those who taught the content that was the least often authentic or grounded, and thus, the easiest for students to be dishonest when completing.

Class Size

Faculty identified class sizes between 65 and 200. The instructor of the senior design class did not mention class size, but because that class was surveyed during Phase 1, it was determined that the senior design class was actually smaller than the classes which lead up to it. This was expected because the senior design class included only graduating seniors from one department and the other classes included multiple engineering disciplines. There were 55 students present in class during the survey, which provided confirmation that the senior class was smaller than the freshman/sophomore class sections.

Large class size was described as a detriment by three of the six instructors interviewed. Themes included budget cuts (less faculty) and increased time needed for grading. To alleviate the grading constraints associated with larger class sizes, one of the instructors in the sequence used a unique online homework tool that graded problems-based content automatically, while scaffolding the content to help guide students. This program gave partial credit while generating unique problems for each student to allow

for ample practice while preventing dishonesty and sharing of answers. Additionally, this same instructor developed a platform for grading multiple choice assessments. The grading platform allowed for coding questions to align with specific learning objectives to allow quick grading and to identify gaps in student knowledge on one assessment before the instructor moves on to new content. This tool was being used for grading and to provide very fast feedback by three of the four "middle" instructors. It is also important to note that these are the same three instructors who described a high sense of caring about their students.

Campus Culture

Two faculty expressed that they felt students were generally honest, which would align with a positive cultural injunctive norm, yet conflict with the negative cultural descriptive norms revealed in the data, (i.e., both student groups perceived that academic dishonesty was more prevalent than what students actually reported). Another instructor, though, expressed that students are generally aware of the lax consequences, which would indicate an injunctive norm that academic dishonesty is generally accepted by students and/or perceived as tolerated by instructors.

The overwhelming majority of faculty comments about campus culture toward academic dishonesty were negative. All six-faculty expressed that the consequences for reporting academic dishonesty were not clear and that the policies and enforcement were lax. According to the faculty, the only consequence for students who were caught being dishonest is for the students to receive a grade of zero on the assignment on which they cheated, but there are no further consequences. This raised questions about the involvement of former students (or students not directly involved in the class) during the

current semester; specially, are former student who help current students to obtain unauthorized answers guilty of dishonesty? And if so, what consequences could be administered?

When asked if they reported academic dishonesty through the appropriate channels, the responses were inconsistent. One instructor personally handled first instances but reported all second instances of dishonesty. Another instructor said that it is so difficult to collect the evidence needed to make a report that they frequently handle dishonesty themselves. The general sentiment is that if an offense is major that they do report it instantly, but that they do not feel, even with egregious cases, that students received "real" consequences. One instructor explained that the current consequences are very rehabilitative instead of punitive and in order for any substantial consequences to be enforced, students would have to do something illegal. Additionally, this instructor described that the faculty have been "declawed," which summarized the responses of the other faculty.

Definitions of Dishonesty

Five of the six faculty described ways that they define academic dishonesty for their students. The most common methods were defining academic dishonesty within the syllabus at the beginning of the semester and talking about it during class. One instructor indicated they define dishonesty for each and every assignment. The majority, though, only gave reminders at key times during the semester such as just before an exam or the assignment of a large project.

One instructor stated that students know the difference between what is dishonest and what is not, but another stated that you have to define it for each class, though this

instructor did not think faculty should have to define academic dishonesty for each class because it should be generally understood as an injunctive norm. Additionally, one instructor went so far as to define specifics ways to be dishonest in the instructions for each assignment.

Engagement

All six-faculty interviewed stated an inverse relationship between engagement and academic dishonesty, meaning that when students were engaged, they were less likely to be dishonest on coursework. Additionally, five of the six responded that students in their class were engaged with the course very often, while the sixth said, “for the majority of students, always.” If the level of engagement is in fact inversely related to academic dishonesty, it could then be predicted that either 1) the faculty in this sequence have mis-judged the level of engagement of their students or 2) the students in these classes would infrequently be academically dishonest. More research is needed to determine this relationship.

The engagement methods described by the faculty did not present any noticeable trend. Faculty described question and answer, discussion of controversial topics, email, homework, worksheets, office hours, use of humor, polling, working on the board, and taking notes all as engagement strategies used with their students during or between classes. The majority of the strategies used were also active learning strategies and it was determined that the faculty interviewees often use active learning to engage the students in their classes.

Another interesting finding in the faculty interviews was the reporting of online discussion tools used outside of class. Two instructors attempted to engage students

between class sessions by incorporating online discussion tools through the campus learning management system, Canvas, as well as another campus-approved collaboration tool, Piazza. Both instructors reported that some classes engage more than others and they had no explanation why certain groups of students may engage with online discussions more. However, the online discussions were not required. Rather, they were added as an additional resource to help students collaborate with the instructor and with other students in the class, so engagement with these tools maybe indicative of higher intrinsic motivation for some students. More research is warranted to investigate this.

Extrinsic Motivation

The most common extrinsic motivators described by the faculty were grades, parents, and peers. All six faculty discussed the influence of grades on academic honesty while two discussed the influence of parents and two discussed the influence of peers, which may be linked to perceived norms as described by the theory of planned behavior (Ajzen, 1991).

Two faculty also tried to incentivize students with external rewards in addition to grades. Both strategies were related to student competition. The first instructor created a leaderboard where students competed for their project to be most accurate or cost effective. The other instructor created competition through an extra credit assignment. For this assignment, students submitted an example of something related to the course that they had experienced in real life. The students then voted on the best example and the winner receives a gift card to a local restaurant. Although optional, the instructor said that approximately 75% of students submitted the assignment. Instructors stated they used these extrinsic motivators to increase engagement and to decrease cheating;

however, previous research indicated that external motivation might actually increase academic dishonesty (Lang, 2013).

Formative Assessment

Faculty frequently used active learning, but they did not always formally assess student activities. Activities that did include formative assessment components were quizzes, homework, discussion, polling, small group problem-solving, pre-class assignments, muddy points, and presentations. The formative assessments described were also the same activities that the faculty described as engaging and active learning.

Grounded Assessment

The introductory and senior design classes both included design projects that were grounded and cannot be replicated from another time, location, or group in a different class in another semester. The project prompts were updated each semester and in the case of the senior design class, the project for each semester was based on a real project that was under construction or had recently been completed. Grounding of assessments in this way greatly reduces the amount of cheating that could happen on the projects (Lang, 2013).

The classes that fall between the two design classes did not have the level of grounding seen in a class that incorporates a unique design project. Two of the faculty described the use of grounded assessment as very little or none while a third provided only two examples: one extra credit assignment where students identified examples in their own environment and a reflection assignment where students wrote down their personal words of wisdom to future students. The fourth “middle” instructor described several technological methods that prevent cheating by creating unique problem sets for

each student, which provided different assessment questions for each student, thus providing one measure of grounded assessment within that instructor's class. Additionally, that same instructor created formative assessments where students could debate controversial topics related to the course content. The instructor described this as another example of grounded assessment in their class.

Intrinsic Motivation

Faculty described the coursework as challenging. Two instructors described an internal motivation that drives the students to want to try pushing themselves to solve the difficult problems in their courses because that is simply part of what makes someone a good engineer. A third instructor explained that some students will perform because they want their ideas to be the best and not just simply get the grade. More research on this topic could help reveal motivational factors.

Prevention

Faculty described file systems that were kept by various groups (fraternities, sororities, etc.). These files provided homework and examination problems from previous semesters to some of their members. To prevent some students from having unfair access, all faculty described changing their assessment questions each semester. Two of the instructors also said they did not return examinations to students in case some questions ever needed to be repeated. Two instructors specifically said they require students who wear hats to turn the bill around backwards so teachers can see the student's eyes during exams.

Technological tools have also been developed to help faculty prevent cheating. Faculty mentioned Turnitin software (2020), which determines originality of content

when scanned against a database of both published and unpublished documents. For the most part, the instructors in this sequence agreed that authentication software of this sort was not useful for their classes because of the math problems-based nature of the assessments. This also helps to confirm the finding that the lower-level students would not exhibit high levels of plagiarism, because they are more likely to have problems-based assignments. When students solve a mathematical problem correctly, it is expected that they would have the exact same steps. However, other technological tools (i.e., reviewing the time it takes to complete an assignment and using vendor created homework) are used by the faculty who were interviewed to prevent copying of problems-based assessments.

One instructor developed a homework platform that provided information about the amount of time each student spent on each question. This allowed the instructor to determine if a student was completing work more quickly than what would be expected, which may indicate dishonesty. Another instructor described a vendor-created homework platform that would provide similar information. And still another instructor described the methods used for comparing digital drawings that students submit to verify that each student created their own, even if the drawings appeared identical on the surface. Overall, the faculty stated that technology can be used to prevent cheating and not as a tool for helping students to cheat more easily.

Public Safety

Though unrelated to teaching or pedagogical strategies, another trend of interest was revealed during the faculty interviews. Three of the six instructors described the importance of engineering ethics as it relates to public safety. When civil, architectural,

and environmental engineers are not ethical and projects fail, consequences can be disastrous, and people can die. More research is needed to elaborate on this finding.

Scaffolding

Four of the six faculty interviewed described content that builds on itself throughout the semester, or scaffolded content. When content is scaffolded, students learn small pieces and then build on existing knowledge (Ambrose et al., 2010). If a student misses something early on, though, faculty explained that it is more difficult to catch up than if each unit starts with stand-alone new information.

Summative Assessment

The instructors of the design courses described the role of summative assessment much differently than those of the middle classes. The summative assessment for each of the design classes was the culminating design project, which had many small, related assessments preceding it. The smaller formative assessments included low-stakes data collection and presentations during the design phase. There were no exams in either of the two design classes. However, students reported some cheating behavior when asked about cheating on exams within these two classes. This could indicate a discrepancy in the understanding of the difference between exams and quizzes used in each class.

The middle classes, however, all include multiple exams, each summative in nature, which comprised most of the points awarded for the semester. Students practiced for those exams by completing homework problems. The nature of the summative assessments closely mimicked the homework problems that were given as practice. Three of the four middle instructors also used a digital grading tool to provide exam feedback to their large-enrollment classes by the class period immediately after the exam.

Additionally, the feedback generated was aligned with the learning objectives assessed on the exam. Interestingly, these were the same three instructors whose responses provided the theme of caring for the student.

Technology

The 2019 classroom was far different from the classroom of Bowers' (1964) study of student academic dishonesty. Every instructor in this study used technology for posting material for students. The four middle instructors also used technology-facilitated homework problems to make grading of large class sections easier and to prevent cheating.

To engage students in class, technology such as polling systems (e.g., Kahoot), video components before and during class, online discussion components through boards in Canvas and Piazza, Quizlet and large databases of homework problems for practice assessment as well as, to administer and grade exams.

Additionally, instructors incorporated technology used by practicing engineers in the design projects. Instructors also described benefits of learning technology outweighing the potential for student use of technology in a dishonest manner.

Students, however, may have also tried to use technology to help them gain an unfair advantage.

Theory of Planned Behavior

Most instructors agreed that because students study together and they may work together on homework, that they could unintentionally cheat when guidelines are not clearly outlined. However, in their own classes, five of the six instructors definitively stated that students who cheat typically do so intentionally.

The one instructor who did not make this statement indicated that some changes have been made to clarify expectations and so the instructor was not sure. That instructor stated that students often claim that it was accidental when they are caught submitting the same assignment in that instructor's class.

The aforementioned file systems indicated a perceived descriptive norm of cheating, or at least unauthorized corroboration, as does repeat offense of the same behavior by the same student. Faculty described perceptions of students as generally honest, but they also described that some students just do not seem to care at all (negative attitude) and those are the ones of whom to be most concerned.

Interpretation of the Results

A quantitative survey of students and faculty coupled with qualitative faculty interviews provided enough data to address each of the research questions and hypotheses posed within this study. A summary of each is described below.

Research Question 1

The first research question in the study attempted to collect the self-reported rates of academic dishonesty of undergraduate engineering students at the freshman/sophomore and senior levels. The study revealed that seniors defined academically dishonest behaviors similarly to faculty, and more strictly than freshman/sophomores for 11 of the 12 specific behaviors defined by the study. The one behavior that seniors did not define more strictly was in relation to padding bibliographies, a form of plagiarism and previous research has associated plagiarism more closely with upper-level students (Khalid, 2015).

There were five findings related to attempted dishonesty. In four of the behaviors where significance was determined, the freshman/sophomore class reported more attempts. Again, the one instance where seniors reported higher rates was related to plagiarism.

The final relationship for the rates of academic dishonesty was related to student perceptions. For two behaviors, the freshman/sophomore students had significantly higher perceptions of dishonesty than their own self-reported behaviors. Their perceptions were high for getting answers from someone who has already taken the exam; and for using unauthorized online/digital resources to obtain answers to homework, assignments, papers, or projects. This finding is indicative of a perceived descriptive norm of these behaviors within the freshman/sophomore population and in support of the theory of planned behavior (Ajzen, 1991).

In summary, graduating seniors reported more strict descriptions/definitions of dishonesty, fewer instances, and less perceived descriptive norm of cheating behaviors except for academic dishonesty involving plagiarism. As a result, it can be concluded that for all behaviors other than those involving plagiarism, $H_0$1 was rejected because students of a higher academic level reported lower rates of academic dishonesty for behaviors. However, the reports of personal ethics revealed no statistically significant differences between the two student groups so H_o1(there would be no differences between student groups in the reporting of their level of personal ethics and/or their self-reported rates of academic dishonesty) was accepted for the reporting of personal ethics.

Research Question 2

The second research question attempted to determine the differences in perceptions of and descriptions/definitions of academic dishonesty between faculty and engineering students. The only significant finding in this comparison was related to copying during an exam. For this behavior, the faculty perception was that it occurred more frequently than what was reported by the students.

The 11 other behaviors within the study showed no significant difference when comparing the student reports to faculty perceptions. As a result, $H_0 2$ was supported for all behaviors other than copying during an exam because the self-reported rates of academic dishonesty by undergraduate engineering students were not higher than the perceived rates reported by the faculty who taught them for 11 of the 12 dishonest behaviors.

Research Question 3

The third research question asked what relationships existed between dishonest choices made by students and the theory of planned behavior (Ajzen, 1991). The freshman/sophomore students reported that it is easier to be dishonest in their class than seniors. The freshman/sophomore students also reported higher perceptions of two types of behaviors than the seniors: sharing exam answers and unauthorized collaboration on homework. When compared with faculty perceptions, students also reported higher perceived rates of dishonesty for seven of the 12 behaviors. These findings are indicative of differing perceived descriptive and injunctive norms between students and faculty, as described by the theory of planned behavior (Ajzen, 1991).

For all 12 dishonest behaviors defined within the study, both student groups also reported a higher perceived rate of the behavior than was recorded in the self-reports of attempted behavior. This again aligns with a perceived behavioral descriptive norm within the environment, which is supported by the theory of planned behavior (Ajzen, 1991). This combination of findings led to the rejection of $H_0$3 because student perceptions of the rates of academic dishonesty were higher than the actual self-reported rates of academic dishonesty, which favors a perceived descriptive norm of dishonest behavior as supported by the theory of planned behavior.

Research Question 4

The fourth research question asked to what degree pedagogical strategies correlated to the rates of dishonesty reported by students. The interviews of the faculty who taught the two classes surveyed revealed that both instructors included active learning and grounded assessment that cannot be replicated by students between semesters. Additionally, the senior class used an authentic project where students design a unique project based on a real design. Furthermore, the freshman/sophomore class included online modules that were not grounded (repeated each semester) and did not provide an authentic experience. The instructor also stated that students were more often dishonest on those modules than on their design projects. When this information was related to the self-reports of academic dishonesty, it was revealed that the freshman/sophomore students reported more instances of dishonesty. It was concluded that $H_0$4 was not supported for three pedagogical strategies because when active learning, grounded assessment, and authentic assessment strategies were used, students reported less academic dishonesty.

Summary

The researchers examined how course pedagogical practices and student attitudes across various academic levels (freshman/sophomore and senior) related to academic dishonesty. The study examined student attitudes, intentions and actions as well as instructor perceptions of the same characteristics based on the theory of planned behavior. The quantitative survey was followed up with qualitative instructor interviews of the pedagogical practices used in their courses to prevent academically dishonest behaviors.

There were 31 freshman/sophomores and 52 seniors who completed the survey in Phase 1 Part A. In Phase 1 Part B, there were six instructors who completed the survey and were interviewed. Due to the small sample size for instructors and the non-normal distribution of data, the Wilcoxon Rank Sum test was utilized to analyze the data in each section of the quantitative survey (Cody, 2016). Cronbach's alpha was used to determine the internal consistency reliability of the survey. The student ethical standard and faculty perceptions of ethical standard varied between the first time they answered the question at the beginning and then again at the end of the survey. The Cronbach's alpha was lower than expected ($r<0.7$).

Twelve academically dishonest behaviors that were defined for the study (see Table 4). In Phase 1 Part A, the student participants were asked to complete the survey and in Phase 1 Part B, faculty were also asked to complete the survey. When comparing the student descriptions between the two student groups there were significant differences ($\alpha=0.05$) between the two student academic levels. Eleven of the 12 behaviors showed significate differences (see Table 8) between the two groups with the only exception

being “Including resources not reviewed or used on a bibliography.” The 11 behaviors were defined more dishonestly by the seniors than the freshman/sophomores.

When comparing the student descriptions with the faculty descriptions (see Table 9) there were significate differences in nine of the 12 behaviors between the freshman/sophomore and faculty groups. As predicted, the faculty defined the behaviors at higher levels of dishonesty than the freshman/sophomores, but there was no significate difference between the faculty and seniors (see Table 10).

Results of the student self-reported attempts of academic dishonesty between the freshman/sophomores and seniors yielded five significant differences: copying without citation; getting answers from someone who has already taken the exam; copying from another student on a test or exam; giving answers to another student during an exam; and using unauthorized digital or online resources on homework, assignment, papers, and projects (see Table 13). The freshman/sophomore students reported significantly more attempts than the seniors for four of the five significant behaviors. The only behavior that seniors reported more frequently than freshman/sophomores was copying a few sentences of material in a paper without proper citation. The project-based types of assignments that seniors are asked to complete may afford the seniors more opportunities to engage in dishonest behavior and report higher instances of this behavior.

The qualitative data from the instructor interviews revealed that when active learning, grounded assessment, and authentic assessment were used, students reported less academically dishonest behavior. The data furthered revealed that while these types of practices were used to engage students more with the content, the trade-off is that this type of practice is more time-consuming to design and requires more class time. The

instructors at the beginning and at the end of the sequence used project-based learning while the four instructors in the middle of the sequence used more problem-based learning. The problems-based instructors described their problems as mimicking real engineering situations. When faculty were asked about engagement, they mentioned there was an inverse relationship between engagement and academic dishonesty, meaning that when students were more engaged, they were less likely to be dishonest on coursework.

The theory of planned behavior relates attitudes, intentions, and subjective norm to the intent to commit a behavior and then the individual's choice to actually behave in a certain way (Ajzen, 1991). Data aligned with the theory. Student attitudes, as measured by their descriptions of the 12 cheating behaviors were more favorable of cheating than those of the instructors. Additionally, freshman/sophomore students exhibited poorer attitudes than the seniors. Both student groups also indicated a perceived descriptive norm of dishonest behavior by reporting higher perceived rates of dishonesty than their self-reported rates for each of the 12 behaviors. Though students were not asked about their intentions within the study, five of the six faculty stated that they believed students who cheat did so intentionally.

Chapter 5 – Discussion, Recommendations, Conclusions

Earlier studies focused on engineering students in general and did not include freshman-level students or technology-facilitated instruction or dishonesty. Students at a public mid-western university who had declared or intended to declare majors of civil, architectural and/or environmental engineering were specifically selected to be studied. Freshman-level students were included in the study but were surveyed after week twelve to mitigate freshman reports of instances of academically dishonest behavior in high school. The student survey instrument (see Appendix A) asked specifically about the fall semester and in the class studied. The survey also asked about technology usage.

Problem Statement and Purpose

An explanatory sequential mixed methods design was used to explain how course pedagogical practices and attitudes of students of various academic levels (freshman/sophomore and senior) related to academic dishonesty. The design was developed to determine the discrepancies in the perceptions of and descriptions/definitions of academic dishonesty among students of various levels of professional maturity and among engineering faculty. The design allowed for the collection of cross-sectional, web-based, quantitative survey data from engineering students and the instructors who taught those students. Additionally, instructors were surveyed for the courses in the sequence which connected the two courses under study: introduction to engineering design and senior design. The survey determined student attitudes, intentions and actions as well as instructor perceptions of the same characteristics as reflected through the theory of planned behavior (Ajzen, 1991).

Qualitative data obtained through interviews of the engineering faculty were used to enrich the quantitative data.

Discussion of Results

The quantitative survey of students and faculty and the qualitative interviews of faculty provided evidence to answer the research questions and hypotheses under study. The information that follows provides a description of the sample population as well as a summary of the findings within the limitations of the study. Implications of the research with a few suggestions for practical application are also described as well as recommendations for future research.

Demographics

Two hundred sixty online student survey submissions were collected during a class period in the fall semester of 2019. The population was narrowed to include 31 freshman/sophomores and 52 seniors who had declared or intended to declare the desired majors of intent. The final student sample size, then was 83 students. Additionally, students in the survey were required to be at least 18 years of age. One student was removed from the freshman/sophomore sample for reporting an age of less than 18 years. Two more students were also removed from the freshman/sophomore class sample because one reported a class level of junior and one reported a class level of senior. Moreover, the instructors who taught the classes in which the students were enrolled were also surveyed and interviewed.

Freshman/Sophomore Demographics

There were 14 male (45.2%) and 17 female (54.8%) students in the sample. Of the 31 students, 30 (96.8%) reported an age of 18-19 years. There were 15 (48.4%) who

reported civil engineering as their intended major, eight (25.8%) architectural engineering, and eight (25.8%) environmental engineering. There were 24 (77.4%) freshman and seven (22.6%) sophomores in the sample.

Senior Demographics

There were 34 (61.8%) male and 18 (32.7%) female students. More than half of the students (n=35, 63.6%) reported ages in the range of 22-23. Additionally, there were 10 (18.2%) students aged 24-25. The remaining students were 20-21 (*n*=2), 26-27 (*n*=1), and 28 or older (*n*=4). There were 34 (61.8%) students majoring in civil engineering, 11 (20.0%) in architectural engineering, and seven (12.7%) students majoring in environmental engineering.

Instructor Demographics

There were 13 instructors invited to participate in the study. This population includes the instructors who taught the two classes surveyed as well as each instructor or graduate teaching assistant who taught a class that connected the two courses in the program sequence. In addition to the instructors who taught the classes surveyed, there were an additional four instructors in the sequence who responded to the request to participate (*n*=6, 46.2%). There were two (33.3%) female and four (66.7%) male instructors. At the time of the study, four (66.7%) of the instructors had taught for 17 plus semesters and two (33.3%) had taught 9-12 semesters. When asked the number of semesters they had been teaching the class in this sequence; three (50%) had taught the class for 17 plus semesters, two (33.3%) had taught 9-12 semester and one (16.7%) had taught 1-4 semesters.

Rates of Academic Dishonesty

The self-reported rates of academic dishonesty were, for the most part, higher for freshman/sophomore-level students. Though this was hypothesized there is little empirical evidence that less experienced students would be dishonest because previous studies avoided collecting data from freshman to prevent reporting on behaviors in high school (Bowers, 1964; McCabe & Trevino, 1993). Results provided evidence in support of assessing the behaviors of students early in their college programs in order to set a baseline of behavior.

Faculty Perceptions of Student Academic Dishonesty

Apart from responses related to copying from another student on a test or exam, the faculty perceived rates of dishonesty no differently from the student reports of dishonesty. For this one significant behavior, the faculty perceived that students were dishonest more than what the students actually reported. This one significant finding could be explained by the discrepancies in descriptions between faculty and students (Carpenter et al., 2006; Carpenter et al., 2010; Jones et al., 2006, 2008; Kelley & Dooley, 2014; McCabe et al., 2012). The lack of significance between self-reports by students and faculty perceptions for the 11 other behaviors supported $H_0$2, which is indicative that the faculty who taught this group of engineering students had an accurate understanding of the amount of academic dishonesty within their own classes.

Summary of Findings

In summary, the findings were as follows. $H_0$1 was not supported for three types of dishonesty because graduating seniors reported more strict descriptions of dishonesty, fewer instances, and a less perceived descriptive norm of cheating behaviors except for

academic dishonesty involving plagiarism. However, $H_0$1 was supported for all other dishonest behaviors and for the self-reported level of personal ethics.

In comparing student self-reports of dishonesty to faculty perceptions of the same, the only significant finding was related to copying during an exam, where faculty perceived that the behavior occurred more frequently than what was reported by the seniors. For the other 11 behaviors, there was no significant difference between the student self-reports and the faculty perceptions. Therefore, $H_0$2 (there would be no differences between the self-reported rates of academic dishonesty by undergraduate engineering students and the perceived rates of dishonesty by the faculty who taught them) was supported for all dishonest behaviors except for copying during an exam. For copying during an examination, $H_0$2 was not supported.

To fully answer Research Question 2, a review of the comparison between the student and faculty descriptions is helpful as well (see Table 10). The data revealed that freshman/sophomore students defined academic dishonesty differently from both senior-level students and the faculty group. However, the seniors and faculty did not define the behaviors with any significant difference. Though these data were collected in an attempt to answer Research Question 2, they provided some support for not supporting $H_0$1 (there would be no significant differences between student groups in the reporting of their level of personal ethics and/or their self-reported rates of academic dishonesty) because students reported more ethical behaviors as they neared graduation, even though their reports of how ethical they believed they personally behaved did not differ significantly between populations. More research is needed to reveal the subtleties that may exist.

Both student groups reported higher perceived rates than their self-reported rates for all 12 dishonest behaviors, which is indicative of a perceived descriptive norm within the population. Additionally, the freshman/sophomore student descriptions were significantly more lax than those of both the senior students and the faculty, which aligns with a negative attitude toward honesty. Though students were not explicitly asked about their intentions, five of the six faculty interviewed stated that they believed students who acted dishonestly did so intentionally. It is important to note, however, that the faculty also indicated that there were times when it was possible for students to be unintentionally dishonest. This information, when combined, illustrates that the dishonest behaviors investigated aligned well with the theory of planned behavior (Ajzen, 1991) as a theoretical framework. Therefore, $H_0$3 was not supported.

Students reported more dishonesty in the class that included online modules that were described by the instructor as neither grounded, nor authentic. Additionally, because the other class included all three pedagogical strategies; active learning, grounded assessment, and authentic assessment, and the reported rates of dishonesty were lower, $H_0$4 was not supported, though additional research is still warranted to compare more than just these two classes.

Limitations

The results cannot be generalized to other engineering degree programs outside of the Department of Civil, Architectural, and Environmental Engineering (CArE). The results also cannot be generalized to an institutional level regardless outside of the STEM-focused nature of the institution. At the time of the study the two courses under investigation were generally offered in a face-to-face environment. Except for a handful

of the students in the senior design class who participated remotely through a live-streamed environment (*n*=4), the findings are not generalizable to the online classroom environment, even though many assessments within the courses made use of technological components. This includes the inability to generalize to the online classroom within other courses at the STEM-focused institution.

The qualitative interview of instructors during Phase 2 invited all instructors who taught the two courses in which students were surveyed as well as instructors who taught the courses in the sequence which connects these two courses. However, because of the small sample size of this population (*n*=6), generalizability of the results across all engineering instructors is not possible. The information collected from the instructor interviews was only used in an attempt to explain the survey data collected from the students within their own classes and how it related to the perceived rates of cheating as reported by the same instructors during Phase 1. Because only one instructor taught each of the two student coures surveyed, another limitation related to sample size was also introduced. In order to protect the anonymity of the instructors, individual comparisons between the freshman/sophomore instructor responses and the senior instructor responses were not possible, though such comparisons may have provided more specific explanations for the results.

Implications

The theory of planned behavior (Ajzen, 1991) provided a theoretical framework for the investigation. The theory of planned behavior relates the attitude toward a specific behavior, the subjective norm of the behavior in a specific population, and the perceived control by the subject over the behavior. These three factors influence the intent to

commit the behavior, which results in the choice to commit or avoid the behavior in question (Ajzen, 1991). Additionally, Ajzen (1991) theorized that "To the extent that a person has the required opportunities and resources, and intends to perform the behavior, he or she should succeed in doing so" (p. 182), meaning that if students do not intend to cheat, that they will not, so long as the environment does not promote or provoke such behavior. Thus, a focus on the educational environment is key to making progress toward preventing dishonesty and improving the campus culture toward honest behavior.

Because the instructors also discussed public-safety concerns, it is evident that the instructors who teach engineering students have their own moral and ethical obligation to take active measures to discourage and prevent dishonesty in the classroom and workplace. This aligns with the theory of planned behavior because, though students have ultimate control over their own behaviors, they do not have control over the classroom environment, assignments, and other assessments and pedagogical strategies used in each class. Therefore, instructors must take the first steps to improve the classroom environment before they can expect student behaviors to change. Additionally, instructor concerns regarding the overall campus culture toward dishonesty must begin with a classroom environment that does everything possible to discourage dishonesty. This is even more important in light of the faculty responses that the campus provides a rehabilitative rather than punitive response to dishonesty.

With the incorporation of technology into the classroom, faculty are able to teach more students because classroom size is no longer a limiting factor. Technology allows live streaming and recorded lessons, assessment and automated grading, and faster communication with large groups. However, as class sizes grow the pedagogical

practices that prevent academic dishonesty (active learning, grounded assessment, authentic assessment) become more difficult because the amount of time to create, incorporate and grade them takes longer.

Recommendations

Both classroom environments investigated provided multiple opportunities for active learning as well as project-based grounded assessments, which are not repeated from semester to semester and thus, more likely to promote student honesty. Additionally, the senior students were exposed to an authentic project, similar to the design projects they would be involved in as working professionals. The results of the student survey supported that the inclusion of these pedagogical strategies; active learning, grounded assessment, and authentic assessment will lead to decreased dishonesty. Therefore, it is recommended that engineering classes incorporate these three strategies as frequently as possible to deter, if not prevent, student academic dishonesty.

Because these strategies take more time to create and implement, institutions need to reevaluate class capacity. Coupled with this recommendation, institutions should reevaluate the curriculum for each engineering class to include active learning, grounded assessment, and authentic assessment if they would like to reduce the amount of academic dishonesty by undergraduate students. Finally, discrepancies in the self-reported behaviors between freshman/sophomore and senior-level students were revealed. Because previous studies did not collect freshman student data (Bowers, 1964; McCabe & Trevino, 1993), more research on academic dishonesty by freshman is warranted.

Future Research

With the expansion of technology-facilitated and online classes, more research is needed to determine how active learning, grounded assessment, and authentic assessment can be incorporated into online environments. Additionally, because the freshman/sophomore students were caught cheating on online modules more frequently, investigations into what pedagogical strategies work better in online environments is warranted.

The sequence studied for this research included both project-based and problems-based courses. The two classes surveyed, at the beginning and end of the sequence, were both described by the faculty as project-based. However, the classes that connected them were all problem-based. Using the same survey from Phase 1 with the classes in the middle of the sequence could reveal important differences between the two class styles. Such a survey might also help to explain the sense of caring that was described by all the instructors who taught the “middle” classes, an unexpected finding in the faculty interviews.

Comparisons of student perceptions revealed that both student groups (freshman/sophomore and senior) perceived higher rates of attempted dishonesty than data they reported. A deeper investigation into the reasons for such perceptions is warranted. Additionally, if the reasons for the discrepancies in perceptions could be unveiled, measures could be taken to reduce the student perceptions of rampant dishonesty and possibly to improve overall campus culture toward academic honesty. Such measures may include student-led programs and policies for addressing academic dishonesty and strategies to bolster intrinsic student motivation to be honest.

Conclusion

Academic dishonesty is prevalent, but not entirely unpreventable. Deterring dishonesty begins with instructional design using pedagogical practices that deter dishonesty. Such practices may include the use of active learning, grounded assessment, and authentic assessment. Faculty concerns about class sizes and the amount of time that it takes to create and implement such practices provide an argument for changes that could be made within the institutional structure.

Institutional changes to limit class size, enhance the curriculum with the use of certain pedagogical strategies, and to increase student involvement in the development of policies and procedures could also lead to improved campus culture toward academic dishonesty. Considering the public safety concerns related to dishonest engineers, a proactive approach to increasing the ethical development of undergraduate engineers is necessary. These changes would not only benefit engineering students, but those who rely on them to design and create safe structures as well because the structures they create are only as reliable as the least ethical engineer who participated in the design process. The integrity of a structure cannot be greater than the integrity of the people who are charged with the responsibility of creating it.

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Appendices

Appendix A – Student Survey Instrument

Q1 Informed Consent
Welcome to the research study: Academic Honesty, Professional Integrity, and Undergraduate Engineering Students: Exploring the Connections, IRB 0212

We are interested in explaining the relationship of course pedagogical practices, attitudes and perceptions of students at various academic levels (freshman/sophomore and senior) related to academic dishonesty. You will be presented with information relevant to academic dishonesty and asked to answer some questions about it. Please be assured that your responses are anonymous and will be kept completely confidential. The researchers will take every effort to keep your data secure using password protected software. We are also providing a random number to track participants in case you later request that your data not be used in the study.
The study should take you around 10 to 15 minutes to complete, and you will receive no incentive for your participation. Your participation in this research is voluntary. You have the right to refuse to participate or withdraw at any point during the study, for any reason, and with no penalty or loss of benefits to which the subject is otherwise entitled.

If you would like to contact the Principal Investigators in the study to discuss this research, please call or e-mail: Jeffrey W. Jennings (573-647-1140), jenningsje@mst.edu or Susan A. Skyles (573201-4952), sas9b1@umsl.edu. If you would like to contact the Principal Investigators' advisor, please call or e-mail: Dr. Keith Miller (314-516-4828), millerkei@umsl.edu.

For additional information regarding human participation in research, please feel free to contact the Missouri S&T Campus IRB Chair, Dr. Kathryn Northcut, at (573) 341-6498
You may write down the above information or take a screen shot before accepting to continue with the survey. By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason.
Please note that this survey will be best displayed on a laptop or desktop computer, but you can use a mobile device.

I consent, begin the study
I do not consent, I do not wish to participate

Q2 Section 1 - Demographics

Random ID number: Please write down this number or take a screenshot of the number for future reference. Because no personal information is being collected in this study, you must reference this randomly-generated number if you decide to revoke your consent and wish to have your data removed from the study. ${e://Field/Random%20ID}

Q3 What is your gender?
Male
Female
Other than specific Male or Female
I prefer not to answer

Q4 What is your current age?
Under 18
18 – 19
20 – 21
22-23
24-25
26-27
28 or older

Q5 Which class level best describes your current academic standing. Please do not include credit hours for courses you are now enrolled in during the current semester.

Freshman (0-29 credit hours)
Sophomore (30-59 credit hours)
Junior (60-89 credit hours)
Senior (90 or more credit hours)

Q6 What is your major or intended major? Select all that apply, but please do not select any intended minors.

Aerospace engineering
Architectural engineering
Ceramic engineering
Chemical engineering
Civil engineering
Computer engineering
Electrical engineering
Engineering management
Environmental engineering

Geological engineering
Mechanical engineering
Metallurgical engineering
Mining engineering
Nuclear engineering
Petroleum engineering
Other, please specify_____
Undecided

Q7 Using a scale of 1 - 5, with 1 being "not at all ethical" and 5 being "very ethical."

	Not at all ethical	2	3	4	5. Very ethical
How ethical are you?	O	O	O	O	O

Q8 Section 2 - Definitions of Academically Dishonest Behavior

Q9 Rate each of the following behaviors as they relate to academic dishonesty.

Academic Dishonesty Scale

	1. Not Dishonest	2. Slightly Dishonest	3. Dishonest	4. Very Dishonest	5. I don't know
Copying a few sentences of material without proper citation in a paper	O	O	O	O	O
Included resources, not reviewed or used, on a bibliography	O	O	O	O	O
Plagiarizing from public material on papers	O	O	O	O	O
Getting questions or answers from someone who has already taken the	O	O	O	O	O

same exam					
Copying from another student on a test or exam	O	O	O	O	O
Working on the same homework with several students when the teacher does not allow it	O	O	O	O	O
Turning in papers done entirely or in part by other students	O	O	O	O	O
Giving answers to other students during an exam	O	O	O	O	O
Using unauthorized crib notes during an exam	O	O	O	O	O
Using unauthorized digital/online resources during a test or exam	O	O	O	O	O
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	O	O	O	O	O
Purchasing homework, essays, papers, etc. from online sources to submit as their own	O	O	O	O	O

Q10 Section 3 - Students' attitudes, intentions and behaviors

Q11 Using a scale of 1 - 5, with 1 being "not at all easy" and 5 being "very easy"

	1. Not at all easy	2.	3.	4.	5. Very easy
How easy is it to be dishonest on assessments (homework, quizzes, exams, etc.) in this class?	O	O	O	O	O

Q12 During the current semester, how often have you attempted the following actions in this class? Please only select one answer for each action.

	0	1	2	3	4 or more
Copying a few sentences of material without proper citation in a paper	O	O	O	O	O
Included resources, not reviewed or used, on a bibliography	O	O	O	O	O
Plagiarizing from public material on papers	O	O	O	O	O
Getting questions or answers from someone who has already taken the same exam	O	O	O	O	O
Copying from another student on a test or exam	O	O	O	O	O
Working on the same homework with several students when the teacher does not allow it	O	O	O	O	O
Turning in papers done entirely or in part by other students	O	O	O	O	O
Giving answers to other	O	O	O	O	O

students during an exam					
Using unauthorized crib notes during an exam	O	O	O	O	O
Using unauthorized digital/online resources during a test or exam	O	O	O	O	O
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	O	O	O	O	O
Purchasing homework, essays, papers, etc. from online sources to submit as their own	O	O	O	O	O

Q13 What is your best judgment about how often a typical engineering student at your university attempts the following actions? Please indicate an answer for each action.

	Not at all	1 to 2 times per semester	3 or 4 times per semester	More than 4 times per semester	Weekly
Copying a few sentences of material without proper citation in a paper	O	O	O	O	O
Included resources, not reviewed or used, on a bibliography	O	O	O	O	O
Plagiarizing from public material on papers	O	O	O	O	O
Getting questions or answers from someone who has already taken the same exam	O	O	O	O	O

Copying from another student on a test or exam	O	O	O	O	O
Working on the same homework with several students when the teacher does not allow it	O	O	O	O	O
Turning in papers done entirely or in part by other students	O	O	O	O	O
Giving answers to other students during an exam	O	O	O	O	O
Using unauthorized crib notes during an exam	O	O	O	O	O
Using unauthorized digital/online resources during a test or exam	O	O	O	O	O
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	O	O	O	O	O
Purchasing homework, essays, papers, etc. from online sources to submit as their own	O	O	O	O	O

Q14 Please verify this question, on a scale of 1 - 5, with 1 being "very ethical" and 5 being "not at all ethical."

	1. Very ethical	2.	3.	4.	5. Not at all ethical
How ethical are you?	O	O	O	O	O

Appendix B – Instructor Survey Instrument

Q1 Welcome to the research study: Academic Honesty, Professional Integrity, and Undergraduate Engineering Students: Exploring the Connections, S&T IRB 0212

We are interested in explaining the relationship of course pedagogical practices, attitudes and perceptions of students at various academic levels (freshman/sophomore and senior) related to academic dishonesty. You will be presented with information relevant to academic dishonesty and asked to answer some questions about it. Please be assured that your responses are anonymous and will be kept completely confidential. The researchers will take every effort to keep your data secure using password protected software. We are also providing a random number to track participants in case you later request that your data not be used in the study.

The study should take you around 10 to 15 minutes to complete, and you will receive no incentive for your participation. Your participation in this research is voluntary. You have the right to refuse to participate or withdraw at any point during the study, for any reason, and with no penalty or loss of benefits to which the subject is otherwise entitled.

If you would like to contact the Principal Investigators in the study to discuss this research, please call or e-mail: Jeffrey W. Jennings (573-647-1140), jenningsje@mst.edu or Susan A. Skyles (573- 201-4952), sas9b1@umsl.edu. If you would like to contact the Principal Investigators' advisor, please call or e-mail: Dr. Keith Miller (314-516-4828), millerkei@umsl.edu.

For additional information regarding human participation in research, please feel free to contact the Missouri S&T Campus IRB Chair, Dr. Kathryn Northcut, at (573) 341-6498.

You may write down the above information or take a screen shot before accepting to continue with the survey. By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 18 years of age, and that you are aware that you may choose to terminate your participation in the study at any time and for any reason.

Please note that this survey will be best displayed on a laptop or desktop computer, but you can use a mobile device.

I consent, begin the study
I do not consent, I do not wish to participate

Q2 Section 1 - Demographics

Random ID number: Please write down this number or take a screenshot of the number for future reference. Because no personal information is being collected in this study, you must reference this randomly-generated number if you decide to revoke your consent and wish to have your data removed from the study.
${e://Field/Random%20ID}

Q3 What is your gender?

Male
Female
Other than specific Male or Female
I prefer not to answer

Q4 Including this semester, how many semesters have you spent teaching college students?

1-4 semesters
5-8 semesters
9-12 semesters
13-16 semesters
over 17 semesters

Q5 Including this semester, how many semesters have you been teaching this class?

1-4 semesters
5-8 semesters
9-12 semesters

13-16 semesters

over 17 semesters

Q6 In a typical semester, how many total instances of academic dishonesty do you investigate in this class? Please select a numerical response which includes instances in all sections.

1-5 instances

6-10 instances

11-15 instances

16-20 instances

Over 20 instances

None

Q7 In a typical semester, how many instances of each of the following behaviors do you encounter in this class?

	Instances				
	0	1-2	3-5	6-8	9 or more
Copying few sentences of material without proper citation in a paper	O	O	O	O	O
Included resources, not reviewed or used, on a bibliography	O	O	O	O	O
Plagiarizing from public material on papers	O	O	O	O	O
Getting questions or answers from someone who has taken the same exam	O	O	O	O	O

	Instances				
	0	1-2	3-5	6-8	9 or more
Copying from another student on a test or exam	O	O	O	O	O
Working on the same homework with several students when the teacher does not allow it	O	O	O	O	O
Turning in papers done Entirely or in part by other students	O	O	O	O	O
Giving answers to other students during an exam	O	O	O	O	O
Using unauthorized crib Notes during an exam	O	O	O	O	O
Using unauthorized digital/online resources during a test or exam	O	O	O	O	O
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	O	O	O	O	O
Purchasing homework, essays, papers, etc. from online sources to submit as their own	O	O	O	O	O

Q8 On average using a scale of 1 - 5, with 1 being "not at all ethical" and 5 being "very ethical."

	1. Not at all ethical	2.	3.	4.	5. Very ethical
How ethical do you think engineering	O	O	O	O	O

students are in the
class you teach?

Q9 Section 2 - Definitions of Academically Dishonest Behavior

Q10 Rate each of the following behaviors as they relate to academic dishonesty.

Academic Dishonesty Scale

	1. Not Dishonest	2. Slightly Dishonest	3. Dishonest	4. Very Dishonest	5. I don't know
Copying a few sentences of material without proper citation in a paper	O	O	O	O	O
Included resources, not reviewed or used, on a bibliography	O	O	O	O	O
Plagiarizing from public material on papers	O	O	O	O	O
Getting questions or answers from someone who has already taken the same exam	O	O	O	O	O
Copying from another student on a test or exam	O	O	O	O	O
Working on the same homework with several students when the teacher does not allow it	O	O	O	O	O
Turning in papers done entirely or in part by other students	O	O	O	O	O
Giving answers to other students during an exam	O	O	O	O	O
Using unauthorized crib Notes during an exam	O	O	O	O	O

Academic Dishonesty Scale

	1. Not Dishonest	2. Slightly Dishonest	3. Dishonest	4. Very Dishonest	5. I don't know
Using unauthorized digital/online resources during a test or exam	O	O	O	O	O
Using unauthorized digital/online resources to obtain answers, to homework assignments, papers, or projects	O	O	O	O	O
Purchasing homework, essays, papers, etc. from online sources to submit as their own	O	O	O	O	O

Q11 Section 3 - Instructor's perception of students' attitudes, intentions and behaviors

Q12 Using a scale from 1-5, with 1 being "not at all easy" and 5 being "very easy":

	1. Not at all easy	2.	3.	4.	5. Very easy
How easy do you think it is for students to be dishonest on your assessments (homework, quizzes, exams, etc.)?	O	O	O	O	O

Q13 What is your best judgment about how often a typical engineering student in this class attempts the following actions? Please indicate an answer for each action.

More than

	Not at all	1 to 2 times per semester	3 or 4 times per semester	4 times per semester	Weekly
Copying a few sentences of material without proper citation in a paper	O	O	O	O	O
Included resources, not reviewed or used, on a bibliography	O	O	O	O	O
Plagiarizing from public material on papers	O	O	O	O	O
Getting questions or answers from someone who has already taken the same exam	O	O	O	O	O
Copying from another student on a test or exam	O	O	O	O	O
Working on the same homework with several students when the teacher does not allow it	O	O	O	O	O
Turning in papers done entirely or in part by other students	O	O	O	O	O
Giving answers to other students during an exam	O	O	O	O	O
Using unauthorized crib notes during an exam	O	O	O	O	O

	Not at all	1 to 2 times per semester	3 or 4 times per semester	More than 4 times per semester	Weekly
Using unauthorized digital/online resources during a test or exam	O	O	O	O	O
Using unauthorized digital/online resources to obtain answers to homework, assignments, papers, or projects	O	O	O	O	O
Purchasing homework, essays, papers, etc. from online sources to submit as their own	O	O	O	O	O

Q14 Please verify this question, on average using a scale of 1 - 5, with 1 being "very ethical" and 5 being "not at all ethical."

	1. Very Ethical	2.	3.	4.	5. Not at all ethical
How ethical do you think engineering students are in the class you teach?	O	O	O	O	O

Appendix C – Instructor Qualitative Instrument

1. What pedagogical practices do you use in your course?
2. How would you describe the role of authentic assessment in your class?
3. How would you describe the role of grounded assessment in your class?
4. How would you describe the role of formative assessment in your class?
5. How would you describe the role of summative assessment in your class?
6. How do you define active learning?
7. How often do you use active learning in you course?
   (Never, Rarely, Sometimes, Very Often, Always)
8. Do you believe students are engaged with the course material during your class?
   (Never, Rarely, Sometimes, Very Often, Always)
9. How would you describe the effect of student engagement on student academic honesty?
10. What measures do you take to prevent academically dishonest student behavior in your classes?
11. What do you believe motivates students to behave in an academically dishonest way?
12. Do you think students who act academically dishonest do so intentionally?
13. How would you describe the campus culture towards academically dishonest behavior?

Appendix D – Cronbach's Alpha Data

Table D1

Freshman/Sophomore ANOVA: Two-Factor Without Replication

Summary

	Count	*Sum*	*Average*	*Variance*
Column 1	31	53	1.71	0.35
Column 2	31	81	2.56	1.71

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	44.39	30.00	1.48	2.56	0.01	1.84
Columns	12.65	1.00	12.65	21.86	0.00	4.17
Error	17.35	30.00	0.58			
Total	77	63				

Cronbach's alpha 0.61

Table D2

Senior ANOVA: Two-Factor Without Replication

Summary

	Count	*Sum*	*Average*	*Variance*
Column 1	52	89	1.71	0.37
Column 2	52	126	2.42	1.54

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	71.03	51	1.39	2.70	0.0003	1.59
Columns	13.16	1	13.16	25.49	6.03E-06	4.03
Error	26.34	51	0.516			
Total	110.53	103				

Cronbach's alpha 0.63

Appendix D – Cronbach's Alpha Data (continued)

Table D3

All Student Data ANOVA: Two-Factor Without Replication

Summary	*Count*	*Sum*	*Average*	*Variance*
Column 1	83	142	1.71	0.35
Column 2	83	207	2.49	1.59

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	115.76	82.00	1.41	2.63	0.00	1.44
Columns	25.45	1.00	25.45	47.38	0.00	3.96
Error	44.05	82.00	0.54			
Total	185.26	165				

Cronbach's alpha 0.62

Table D4

Faculty ANOVA: Two-Factor Without Replication

Summary	*Count*	*Sum*	*Average*	*Variance*
Column 1	6	13	2.17	0.17
Column 2	6	15	2.5	0.7

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	2.67	5.00	0.53	1.60	0.31	5.05
Columns	0.33	1.00	0.33	1.00	0.36	6.61
Error	1.67	5.00	0.33			
Total	4.67	11				

Cronbach's alpha 0.38